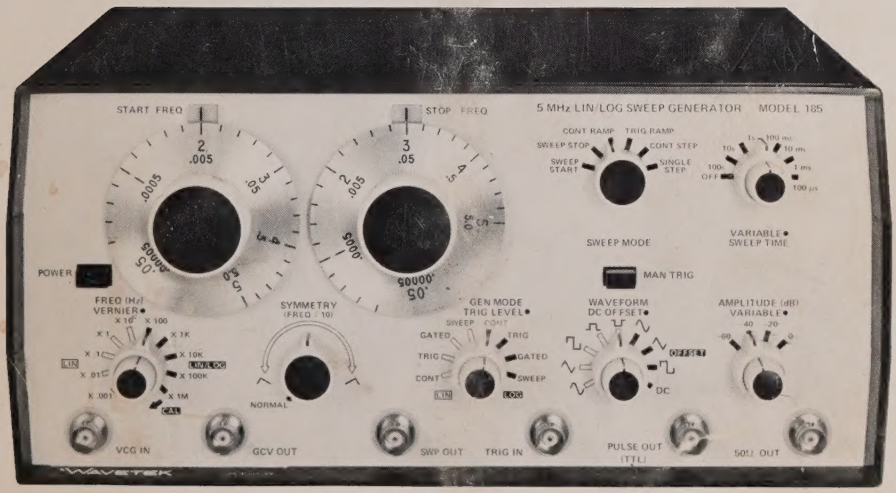
INSTRUCTION MANUAL

MODEL 185
5 MHz LIN / LOG
SWEEP GENERATOR



WAVETEK

WARRANTY

All Wavetek instruments are warranteed against defects in material and workmanship for a period of one year after date of manufacture. Wavetek agrees to repair or replace any assembly or component (except batteries) found to be defective, under normal use, during this period. Wavetek's obligation under this warranty is limited solely to repairing any such instrument which in Wavetek's sole opinion proves to be defective within the scope of the warranty when returned to the factory or to an authorized service center. Transportation to the factory or service center is to be prepaid by purchaser. Shipment should not be made without prior authorization by Wavetek.

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TEC 000591

MODEL 185
5 MHz LIN / LOG
SWEEP GENERATOR

WAVETEK
Box 651, San Diego, Calif., 714-279-2200

8/75

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SECTION 1
GENERAL DESCRIPTION

1.1 THE MODEL 185

Wavetek Model 185, the 5 MHz Lin/Log Sweep Generator, is a precision source of sine, triangle, square, positive pulse and negative pulse waveforms plus dc voltage. Frequency of the waveforms is manually and remotely variable from 100 μHz to 5 MHz. Frequencies are variable both linearly and logarithmically.

The generator can repetitively sweep between two individually set frequencies either linearly or logarithmically and at a particular sweep rate. The sweep of frequencies can also be taken in 10 equal steps, giving 11 frequency levels.

The amplitude of waveforms is variable from 20V p-p, open circuit maximum, to −80 dB. DC reference of the waveforms can be offset positively and negatively.

The symmetry of the waveforms is continuously adjustable from approximately 1:19 to 19:1. Varying symmetry provides variable duty cycle pulses, sawtooth and asymmetrical sine waveforms.

A voltage representing generator frequency, a fixed-amplitude pulse train of that frequency, and a voltage ramp representing frequency sweep rate are provided as front panel outputs.

1.2 SPECIFICATIONS

Specifications (waveform, frequency, and amplitude selection), operating modes, precision (accuracy), and waveform purity (quality) are listed in the following paragraphs.

1.2.1 Versatility

Waveforms
Five selectable waveforms, sine ∿ , triangle △ , square ⊓ , positive pulse ⎍ , negative pulse ⎎ , plus variable DC output. Symmetry of all waveform outputs is continuously adjustable from approximately 1:19 to 19:1. Varying symmetry provides variable duty cycle pulses, sawtooth, or asymmetrical sine waveforms. Separate sync output is included.

Control
Frequency can be controlled manually, with external voltage (VCG) or with internally generated ramp voltage. Both linear and logarithmic distribution of frequencies are available. Besides sweeping with the internal ramp voltage, the frequency may be varied with an internal 10 step voltage. Frequency may be swept, or stepped, up or down; frequency limits are set by two independent frequency dials.

Operating Frequency Range
Frequency selectable from 0.0001 Hz to 5 MHz in the following linear ranges:

X 0.001	0.0001 Hz to 0.005 Hz
X 0.01	0.001 Hz to 0.05 Hz
X 0.1	0.005 Hz to 0.5 Hz
X 1	0.05 Hz to 5 Hz
X 10	0.5 Hz to 50 Hz
X 100	0.5 Hz to 500 Hz
X 1K	5 Hz to 5 kHz
X 10K	50 Hz to 50 kHz
X 100K	500 Hz to 500 kHz
X 1M	5 kHz to 5 MHz

Frequency selectable from 0.005 Hz to 5 MHz in the following logarithmic ranges (5 decades of frequency per range):

X 100	0.005 Hz to 500 Hz
X 1K	0.05 Hz to 5 kHz
X 10K	0.5 Hz to 50 kHz
X 100K	5 Hz to 500 kHz
X 1M	50 Hz to 5 MHz

NOTE

When SYMMETRY control is used, the output frequency is different from the dial indicated frequency. The maximum symmetry ratio obtainable is also dependent on the frequency dial setting.

Main Output
∿ , △ , ⊓ ; variable to 20V p-p into open circuit and 10V p-p into 50Ω load. DC offset of waveform (or DC if selected) is adjustable to ±10 volts open circuit and ±5 volts into 50Ω load.

⎍ , ⎎ , DC: 0 to +10 or −10 volts into open circuit and 0 to +5 or −5 volts into 50Ω load.

Output dc voltage is limited to approximately ±10 volt open circuit and output current is limited to approximately 130 mA.

Output can be attenuated from 0 dB to −80 dB: −60 dB in 20 dB steps, plus a 20 dB vernier for continuous variation (20 dB vernier does not affect offset or DC).

Pulse Output
Output voltage is TTL compatible. Rise and fall times are typically 15 ns. Sync is normally a symmetrical square waveform; with SYMMETRY control ON, it is rectangular.

Sweep Output
SWEEP OUT connector provides an open circuit 0 to +7.5V (approximately) ramp from a 600Ω impedance source and a stair step waveform in 10 steps, when step sweep is selected.

DC Offset
DC offset of ∿ , ∿ , or ⎍ waveform, or DC if selected, is adjustable to ±10 volts open circuit and ±5 volts into a 50Ω load. Output current is limited to approximately 130 mA. Waveform + offset is limited to ±10V into an open circuit.

GCV Output
A dc voltage proportional to the instantaneous frequency of the generator output. 0 to +5V, open circuit, 1 kΩ source impedance.

1.2.2 Operating Modes

Continuous
Operating as a standard VCG (voltage controlled generator), frequency output is determined by front panel control settings in conjunction with external control voltage at VCG IN.

Triggered
Only one complete cycle of output appears at 50Ω OUT connector for each pulse applied to TRIG IN connector (or press of MAN TRIG switch).

Gated
Same as triggered mode except that output oscillations continue for duration of gating signal applied to TRIG IN connector (or as the MAN TRIG switch is depressed).

Sweep
The internal ramp generator can sweep the main generator up or down in frequency, linearly (3 decades) or logarithmically (5 decades), up or down, or in 10 discrete steps. The main generator output may be continuous or triggered for one sweep or one step.

Sweep/Step Time: The time for each sweep/step ramp can be varied from 100s to 100 μs in 6 ranges.

1.2.3 Voltage Controlled Generator

VCG Control Range: In linear mode, up to 1000:1 frequency change with external voltage input. In logarithmic mode, up to 100,000:1 change. Upper frequency limited to max of selected range.

Input Impedance: 10 kΩ.

VCG Voltage: 0 to 5V.

Linear VCG Slew Rate: 2% of range per μs.

Logarithmic VCG Slew Rate: 0 to 80% of range in 40 μs
80 to 100% of range in 200 μs

Linear VCG Response: 0.1 mHz to 50 kHz ±0.5%.

Logarithmic Response: Approximately one decade of frequency per volt input.

1.2.4 Triggered Generator

Trigger pulse is 1V p-p to ±10V; input impedance is 10 kΩ, 33 pF; minimum pulse width is 50 ns; maximum repetition rate is 5 MHz.

1.2.5 Horizontal Precision

Dial Accuracy (Symmetrical Waveform and Linear Mode)
±2% of full scale for 0.005 Hz to 5 MHz.
±4% of reading and ±2% of full scale for 0.0005 Hz to 0.005 Hz.

Frequency Vernier
Approximately 1% of range in linear scale. Approximately 5% of reading in logarithmic scale. Vernier affects calibration of both frequency dials.

Time Symmetry
±1% for 0.005 to 500 kHz.

1.2.6 Vertical Precision

Amplitude Change With Frequency (Sine)
Less than 0.1 dB to 100 kHz.

Less than 0.2 dB to 1 MHz.
Less than 1 dB to 5 MHz.

Step Attenuator Accuracy
±0.3 dB per 20 dB step.

Stability
Short Term: ±0.05% for 10 minutes.
Long Term: ±0.25% for 24 hours.

Percentages apply to amplitude, dc offset and main generator frequency in the linear mode.

Amplitude Symmetry
±1% of amplitude range to 1 MHz for all symmetrical waveforms.

1.2.7 Purity

Sine Distortion
Less than 0.5% for 10 Hz to 100 kHz.
Less than 1% for 0.005 to 1 MHz.
All harmonics at least 30 dB down for 1 to 5 MHz.

Triangle Linearity
Greater than 99% for 0.0005 Hz to 100 kHz.

Square Wave Rise and Fall Time
Less than 25 ns terminated into 50Ω load.

Square Wave Total Aberrations
Less than 5%.

1.2.8 Environmental

All specifications listed are for 25°C ±5°C. For operation from 0°C to 55°C, specifications including horizontal precision, amplitude symmetry, and sine wave distortion are derated by a factor of 2.

1.2.9 Mechanical

Dimensions
11¼ in./28.6 cm wide; 5¾ in./14.5 cm high; 10¾ in./27.3 cm deep.

Weight
8.5 lb/3.8 kg net; 12 lb/5.5 kg shipping.

1.2.10 Power

90V to 110V, 105V to 125V, 180V to 220V or 210V to 250V; 50 Hz to 400 Hz; less than 25 watts.

NOTE

Specifications apply from 10 to 100% of a selected frequency range with SYMMETRY control OFF.

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SECTION 2
INITIAL PREPARATION

2.1 UNPACKING INSPECTION

After carefully unpacking the instrument, inspect the external parts for damage to knobs, dials, indicators, surface areas, etc. If there is damage, file a claim with the carrier who transported the instrument. Retain the shipping container and packing material for use in case reshipment is required.

2.2 PREPARATION FOR USE

Before connecting the instrument to line power, be sure the rear panel 115/230V and HI/LO switches are set to the value nearest the line voltage and that the fuse is correct for the switch setting. Be sure that the plug on the power cord is the proper mate for the line receptacle.

AC Line Voltage	Switch A	Switch B	Fuse (SB)
90 - 110	115	LO	1/4 amp
105 - 125	115	HI	1/4 amp
180 - 220	230	LO	1/8 amp
210 - 250	230	HI	1/8 amp

2.3 ELECTRICAL ACCEPTANCE CHECK

This checkout procedure verifies the generator operation. If a malfunction is found, refer to the Warranty in the front of this manual. An oscilloscope, 50Ω coax cable and 50Ω feedthru are needed for this procedure (figure 2-1).

Preset the generator front panel controls as follows:

Control	Position
GEN MODE	CONT (LIN)
WAVEFORM	∿
SYMMETRY	NORMAL
FREQ Range	X 1K
FREQ VERNIER	CAL
START FREQ Dial	1
AMPLITUDE	0 dB
AMPLITUDE VARIABLE	Full clockwise
DC OFFSET	Center
TRIG LEVEL	Full counterclockwise
SWEEP MODE	CONT RAMP
STOP FREQ Dial	5
SWEEP TIME Range	10s‖1s
SWEEP TIME VARIABLE	Full clockwise

Perform the steps in table 2-1. Only approximate values are required to verify operation.

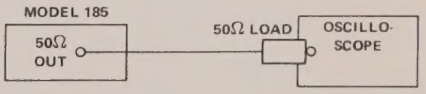


Figure 2-1. Acceptance Test Setup

Table 2-1. Performance Checkout

Step	Control	Position/Operation	Observe at 50Ω OUT
	Function		
1	POWER	Push on	Sine wave, 1 kHz, 10V p-p
2	WAVEFORM	∿	Triangle wave
3	WAVEFORM	⊓	Square wave
4	WAVEFORM	⎍	Positive pulse

Table 2-1. Performance Checkout (Continued)

Step	Control	Position/Operation	Observe at 50Ω OUT
5	WAVEFORM	⊔	Negative pulse
6	SYMMETRY	cw	Frequency ÷ 10, decreasing negative pulse width
7	SYMMETRY	ccw	Decreasing positive pulse width
8	SYMMETRY	NORMAL	– – –
9	WAVEFORM	∿ (OFFSET)	Sine wave, 1 kHz
	Frequency		
10	FREQ Range	X 1M	Frequency = 1 MHz
11	FREQ VERNIER	ccw	Frequency decreases 1%
12	FREQ VERNIER	CAL	– – –
13	START FREQ Dial	5	Frequency = 5 MHz
14	GEN MODE	CONT (LOG)	Frequency = 500 kHz
15	START FREQ Dial	0.00005	Frequency = 50 Hz
16	GEN MODE	CONT (LIN)	Frequency = 50 Hz
17	FREQ Range	X100K thru X.001	Decrease in frequency
18	FREQ Range	X1K	Frequency = 50 Hz
19	START FREQ Dial	1	– – –
	Amplitude		
20	AMPLITUDE Range	–60 dB	10 mV p-p
21	AMPLITUDE VARIABLE	ccw	1 mV p-p
22	AMPLITUDE Range	0	1V p-p
23	DC OFFSET	cw	Positive slew; about +5V positive peak
24	DC OFFSET	ccw	Negative slew; about –5V negative peak
25	WAVEFORM	∿ (Not OFFSET)	Triangle wave
	Trigger & Gate		
26	GEN MODE	TRIG (LIN)	0 Vdc
27	MAN TRIG	Press	Generate one cycle

Table 2-1. Acceptance Check (Continued)

Step	Control	Position/Operation	Observe at 50Ω OUT
28	GEN MODE	GATED (LIN)	0 Vdc
29	MAN TRIG	Press and hold	Continuous ^v waveform
30	MAN TRIG	Release	0 Vdc
	Sweep		
31	GEN MODE	SWEEP (LIN)	Frequency sweep from START FREQ setting to STOP FREQ setting every 1s.*
32	SWEEP MODE	TRIG RAMP	Start frequency = 1 kHz
33	MAN TRIG	Press	Generate one sweep
34	SWEEP MODE	CONT STEP	Frequency step 1/11 of sweep range every 1s, reset after 10th step.
35	SWEEP TIME VARIABLE	Full ccw	10s steps
36	SWEEP TIME Range	1s▮100 ms	1s steps
37	SWEEP MODE	SINGLE STEP	– – –
38	MAN TRIG	Press	One step

*This is a good time to check the other outputs by disconnecting the cable at 50Ω OUT and connecting to SWP OUT: observe a 7.5 V ramp waveform. Connect to GCV OUT: observe a ramp plus dc. Connect to Pulse OUT; observe 2.4 V positive pulse. Reconnect cable to 50Ω OUT and continue with step 32.

SECTION 3
OPERATION

3.1 CONTROLS AND CONNECTORS

The generator front panel controls and connectors are shown in figure 3-1 and keyed to the following descriptions:

(1) POWER Switch

Power is turned on and off with the POWER push-button. The START FREQ dial index (1A) lights when power is turned on.

(2) START FREQ Dial

Frequency settings of the dial multiplied by frequency range (18) determine output frequency. In frequency sweep operation, this dial determines the frequency from which sweep is started.

(3) STOP FREQ Dial

This dial is used in sweep mode only. Frequency settings of the STOP FREQ dial multiplied by frequency range (18) determines the frequency at which sweep is stopped. (See figure 3-2.) Setting this dial for values greater than the START FREQ dial (2) settings define upward sweeping frequencies, and setting it for lower values than start frequency settings define downward sweeps.

(4) SWEEP MODE Selector

The SWEEP MODE selector is enabled by the GEN MODE selector (14) set to SWEEP. The STOP FREQ dial index (4A) turns on when SWEEP mode is selected. An internally-generated

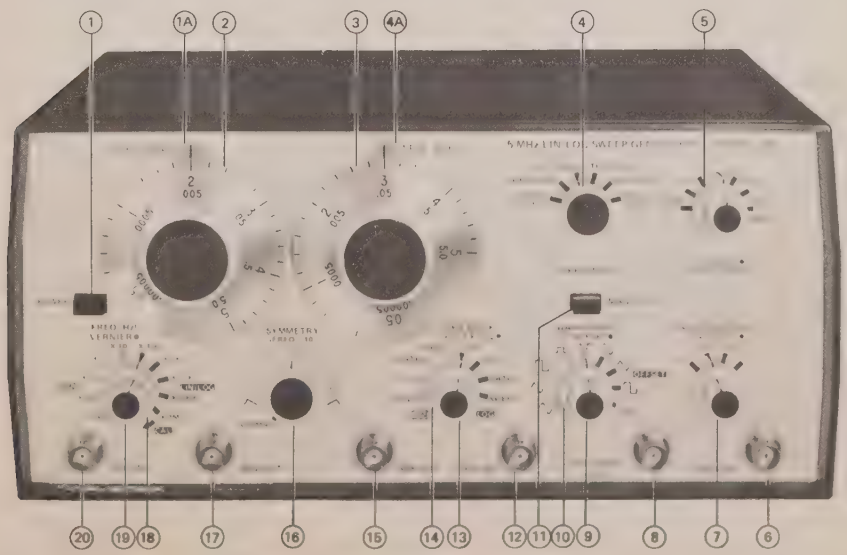


Figure 3-1. Front Panel Controls and Connectors

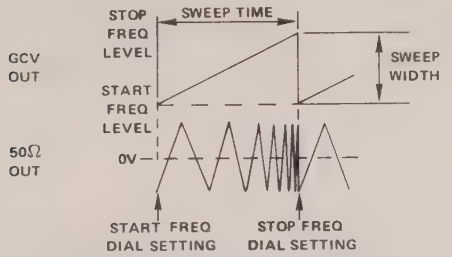


Figure 3-2. Effect of Sweep Time and Width on Output Frequency

voltage ramp becomes an internal VCG input. The start frequency of the generator is determined by the START FREQ dial (2) and the stop frequency is determined by the STOP FREQ dial (3). The SWEEP START and SWEEP STOP settings will hold the output signal at the start and stop frequencies, respectively, while the START FREQ (2) and STOP FREQ (3) dials are adjusted. CONT RAMP allows frequency sweeping to occur at the rate set by (5). TRIG RAMP allows triggering by (11) or (12) of a single sweep. CONT STEP allows 10 equal frequency steps (11 levels), the first level set by (2), the last by (3). Step duration is set by (5) (see figure 3-3). Single step allows triggering by (11) or (12) of a single step in frequency.

(5) SWEEP TIME Control

Frequency of the internal sweep ramp, and thus, the sweep repetition rate, is governed by the SWEEP TIME control (see figure 3-2). The large knob, when rotated to a detent line, determines the range controlled by the VARIABLE knob. The range values are shown on either side of the detent line. In OFF position, the ramp generator is turned off.

(6) Main Output Connector

Maximum output of 10V p-p signals into a 50Ω load (20V p-p open circuit) is provided at the 50Ω OUT connector; all generator mode signals are delivered at this connector. See (7) for amplitude of output.

(7) AMPLITUDE Control

The AMPLITUDE switch affects waveforms, dc output and waveform dc offset. The VARIABLE control affects waveforms only. Maximum waveform amplitude is with the 0 dB setting of the AMPLITUDE control and with the VARIABLE control fully cw (see table 3-1). Amplitude is decreased 20 dB with VARIABLE control fully ccw.

Table 3-1. Maximum Voltage at 0 dB

Function	Open Circuit	50Ω Termination
∿ , ⩘ , ⊓	20V p-p	10V p-p
⎍	0 to +10V	0 to +5V
⎎	0 to −10V	0 to −5V
DC	±10V	±5V

(8) Synchronizing Pulse Output Connector

A fixed amplitude (0 to about 5V) TTL pulse of the generator frequency is provided at the PULSE OUT connector. This output can be used as a synchronizing reference for the main output (6). Phase of the waveforms relative to the sync output is shown in figure 3-4.

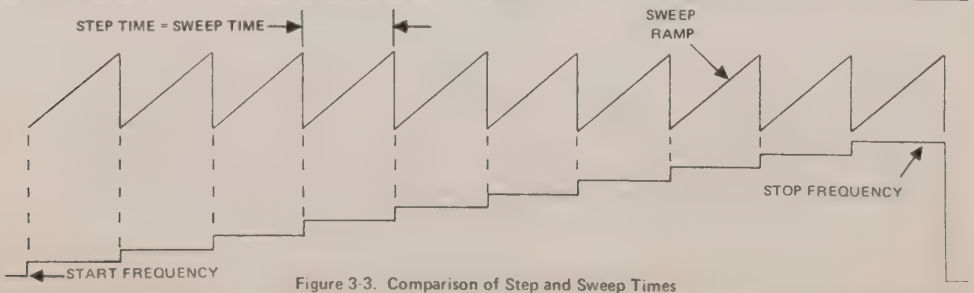


Figure 3-3. Comparison of Step and Sweep Times

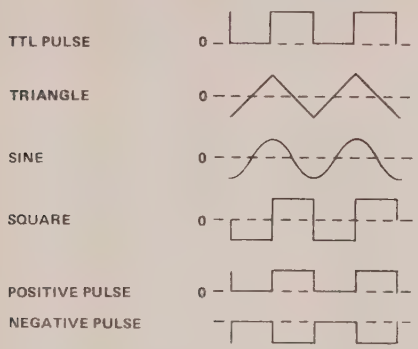


Figure 3-4. Pulse/Waveform Phase Relationship and Waveform Reference Lines

⑨ DC OFFSET Control

Offset of waveforms and dc voltage are controlled by the DC OFFSET control. The WAVEFORM switch ⑩ must be in one of the four right-hand settings. Center of the waveform reference (figure 3-4) is skewed positive with clockwise rotation, negative with counterclockwise rotation. Offset and dc voltage maximums are ±5V (50Ω terminated). See figure 3-5 for restrictions.

⑩ WAVEFORM Selector

Sine ∿ , triangle ⩘ , and square ⎍ waveforms, and positive and negative square pulse trains ⎍ , ⊔ are selected for output by the WAVEFORM selector, with or without dc offset. When set for dc offset, the inner knob ⑨ controls the ±5V (50Ω terminated) offset. DC is selected for dc output with voltage controlled by the inner knob ⑨ .

⑪ Manual Trigger Control

In TRIG mode ⑭ , the MAN TRIG pushbutton is used to trigger a single cycle of waveform output and, in the GATED mode, to gate the output of waveforms until released.

NOTE

The TRIG LEVEL control ⑬ must be fully CCW.

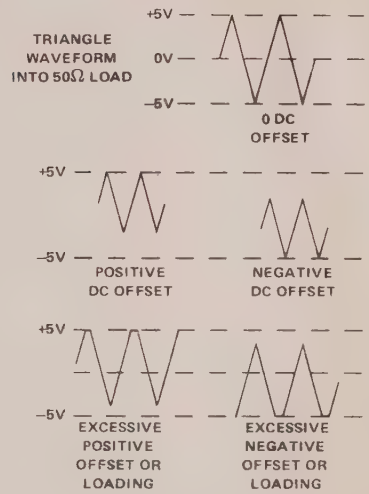


Figure 3-5. DC OFFSET Control

⑫ Remote Trigger Input Connector

The TRIG IN connector accepts voltage level inputs that trigger and gate the generator. (See ⑭ and ④ .) The trigger level control ⑬ determines the level at which the TRIG IN input is accepted for triggering or gating. A positive-going excursion through a voltage level, which can be set in the range of −7.5V to +7.5V by the TRIG LEVEL control triggers or gates the generator operation.

A negative-going dc excursion through the trigger level ends gated operation. Figure 3-6 shows triggering and gating of the generator waveforms at time t1. Once triggered or gated, a full cycle of the selected waveform is output to its completion: when gating is removed at time t2, for example, the last full cycle of waveform completes itself at time t3.

⑬ Trigger Level Control

The TRIG LEVEL control determines the level at which the input at the TRIG IN connector ⑫ is accepted as a trigger in the generator trigger and gated modes. (See ⑭ and ④ .) The trigger level can be varied from fully clockwise, where a positive-going excursion thru −7.5V is a trigger, to fully counterclockwise, where a positive-going excursion thru +7.5V is a trigger.

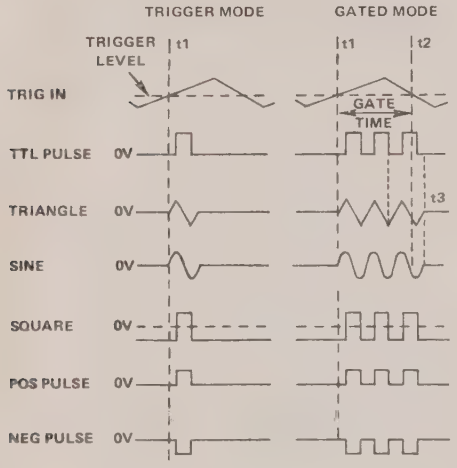


Figure 3-6. Generator Trigger and Gated Control

(14) Generator Mode Selector

Linearly (LIN) or logarithmically (LOG) calibrated control of continuous (CONT), triggered (TRIG), or GATED frequencies or the sweep or step modes of frequency (SWEEP) is selectable as the generator mode of operation by the GEN MODE selector.

Generator modes are:

1. Continuous – An uninterrupted output of the selected waveform at the selected frequency and amplitude.

2. Triggered – One cycle of the selected waveform at the selected frequency and amplitude when the trigger signal is detected at TRIG IN (12) or when manually triggered at (11) .

3. Gated – A burst of the selected waveform at the selected frequency and amplitude, which starts when the gate signal is detected at TRIG IN (12) and lasts through the completion of the last cycle started before the removal of the gate signal, or starts and stops when manually gated at (11)

4. Sweep – One of several modes controlled by (4) . Main generator frequencies may be swept up and down or stepped up and down. Sweep and step may be continuous or triggered.

(15) Sweep Ramp Output Connector

The internal sweep generator ramp is available at the SWP OUT connector. Ramp frequency is varied by the SWEEP TIME control. (See figure 3-2.) Output is a 0 to +5V ramp, 600Ω source impedance.

(16) Waveform SYMMETRY Control

Normal symmetrical output results when SYMMETRY is set to NORMAL; an asymmetrical, or unbalanced, waveform results when SYMMETRY is set between ◺ and ◹ . (Asymmetric operation reduces generator frequency to approximately 1/10th the normal output.) Figure 3-7 shows the effect of SYMMETRY control on the waveforms.

NOTE

When SYMMETRY control is used, the output frequency is different from the dial indicated frequency. The maximum symmetry ratio obtainable also depends on the frequency dial setting. Typical examples are shown in tables 3-2 and 3-3.

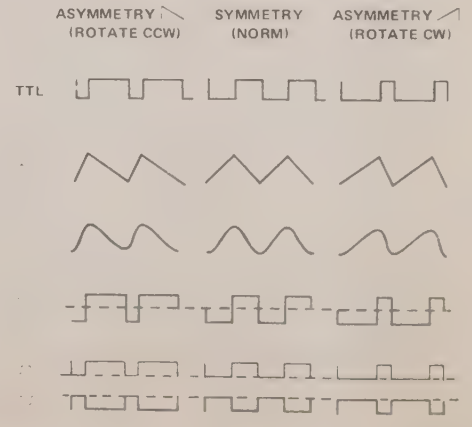


Figure 3-7. Effect of SYMMETRY Control

Table 3-2. Linear Dial Setting

Frequency Range	X 100K					
Dial Setting	5	4	3	2	1	0.5
Indicated Frequency	500 kHz	400 kHz	300 kHz	200 kHz	100 kHz	50 kHz
Output Frequency	54 kHz	44 kHz	33 kHz	23 kHz	12 kHz	6.5 kHz
Maximum Symmetry Ratio	18:1	18:1	18:1	17:1	16:1	15:1

Table 3-3. Logarithmic Dial Setting

Frequency Range	X 100K					
Dial Setting	5	0.5	0.05	0.005	0.0005	0.00005
Indicated Frequency	500 kHz	50 kHz	5 kHz	500 Hz	50 Hz	5 Hz
Output Frequency	53 kHz	7.6 kHz	1.7 kHz	420 Hz	63 Hz	6 Hz
Maximum Symmetry Ratio	18:1	15:1	9:1	2.2:1	1.2:1	1:1

⑰ **GCV Output Connector**

GCV OUT provides dc excursions of 0 to about +5V which represent the output frequency in the selected range. Source impedance is 1 kΩ.

⑱ **Frequency Range Control**

The selected range settings of the FREQ selector, multiplied with the frequency dial ② setting determine output frequency. LIN settings are for linear modes only. LIN/LOG settings are for linear or logarithmic modes.

⑲ **Frequency VERNIER Control**

The frequency is as labeled on ⑱ and ②, when the VERNIER control is set fully clockwise to CAL (calibrated). Rotating the VERNIER control counterclockwise decreases output frequency. The range is approximately 1% of the selected frequency range.

⑳ **VCG Input Connector**

DC voltage excursions of 0 to ±5 volts at the VCG IN connector control frequency within the selected range. Positive inputs increase frequencies set by the frequency dial ② and range control ⑱, and negative inputs decrease the frequencies. Input impedance is 10 kΩ. Frequency excursions of 1000:1 (linear mode) and 100,000:1 (logarithmic mode) are possible.

3.2 OPERATION

Operation is discussed in terms of continuous, triggered, gated, sweep (and step) and VCG.

3.2.1 Signal Termination

Proper signal termination, or loading, of the generator connectors is necessary for its specified operation. For example, the proper termination of the main output is shown in figure 3-8. Placing the 50Ω terminator, or 50Ω resistance, in parallel with a higher impedance matches the receiving

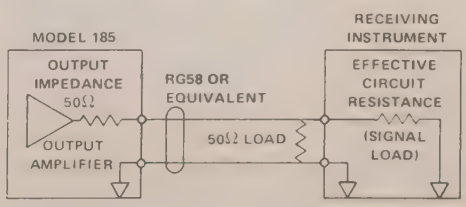


Figure 3-8. Signal Termination

instrument input impedance to the generator output impedance, thereby minimizing signal reflection or power loss on the line due to phase angle mismatch.

The input and output impedance of the generator connectors are listed below:

Connector	Impedance
50Ω OUT	50Ω
TRIG IN	10 kΩ
PULSE OUT (TTL)	*
SWP OUT	600Ω
VCG IN	10 kΩ
GCV OUT	1 kΩ

*The PULSE OUT connector can drive up to 20 Transistor-Transistor Logic (TTL) loads (low level between 0V and 0.4V, and high level between 2.4V and 5V).

3.2.2 Continuous Operation

Basic, or continuous, operation of the generator involves turning on power, selecting a continuous output mode, selecting a waveform, and setting the output signal frequency and amplitude. When operation is critical, allow a one-half hour warm-up period. The following steps demonstrate use as a basic function generator:

Step	Control/Connector	Setting
1	50Ω OUT	Connect circuit (refer to paragraph 3.2.1).
2	PULSE OUT	Use for external synchronization, if required.
3	GEN MODE	CONT (LIN or LOG).
4	WAVEFORM	Choose one of the left-hand set of waveforms. If dc or dc offset is desired, use right-hand set.
5	SYMMETRY	NORMAL or desired asymmetry. (Affects frequency calibration.)
6	FREQ	As desired for frequency range.
7	START FREQ Dial	As desired for exact frequency.
8	FREQ VERNIER	CAL, unless extreme frequency accuracy is required, in which case, monitor with a frequency counter.
9	AMPLITUDE	As desired.
10	AMPLITUDE VARIABLE	As desired.
11	DC OFFSET	As desired (step 4, right-hand set of waveforms must be chosen).

3.2.3 Trigger Mode

Operation as a triggered one cycle generator is as for a basic function generator, only the operating mode is triggered (TRIG) instead of continuous (CONT), and a manual or remote trigger (MAN TRIG, TRIG IN) is used to start the single cycle of waveform. Perform the steps given in paragraph 3.2.2, only set the GEN MODE control in step 3 to TRIG. Refer to paragraph 3.2.4 for triggering.

NOTE

The generator sweep circuit can be used as source of repetitive trigger inputs.

3.2.4 Triggering

Manual trigger as follows:

Step	Control/Connector	Setting
1	TRIG LEVEL	Full ccw.
2	MAN TRIG	Press for each cycle desired.

Remote trigger as follows:

Step	Control/Connector	Setting
1	TRIG LEVEL	Rotate the TRIG LEVEL control cw to set negative thresholds as low as −7.5V through which a positive-going TRIG IN connector input can pass to provide triggering. CCW sets positive thresholds of up to +7.5V through which a positive-going TRIG IN level can pass to provide triggering.

Step	Control/Connector	Setting
2	TRIG IN	Apply a positive-going voltage (through the threshold set in the preceding step) to the TRIG IN connector to provide remote triggering.

CAUTION

Avoid voltages greater than ±50V at TRIG IN to prevent damage to the generator.

3.2.5 GATED (or Tone Burst) Mode

Operation as a gated or tone burst generator is as for a triggered generator, only the operating mode is GATED, and releasing the MAN TRIG or removing the remote trigger voltage ends the burst of output waveform. Perform the steps of paragraph 3.2.2, only set the GEN MODE control to GATED. Refer to paragraph 3.2.4 for triggering.

3.2.6 SWEEP Mode

The generator can be set for a repetitive sweep (CONT RAMP), triggered sweep (TRIG RAMP), repetitive stepping (CONT STEP) or single steps (SINGLE STEP) of output frequencies within a given range. Operation is like continuous mode, only a separately controlled, internal ramp generator or step generator provides an additional VCG input to control frequency. (This internally-generated ramp or step is also available at the SWP OUT connector.) The sweep or step rate is controlled by the SWEEP TIME control. Perform the steps given in paragraph 3.2.2, only set the GEN MODE control in step 3 to SWEEP and include the following steps:

Step	Control/Connector	Setting
1	SWEEP MODE	SWEEP START.
2	START FREQ Dial	Desired start sweep/step frequency.
3	SWEEP MODE	SWEEP STOP.
4	STOP FREQ Dial	Desired stop sweep/step frequency.
5	SWEEP MODE	Desired mode.
6	SWEEP TIME	As desired.

For triggering in TRIG RAMP mode, refer to paragraph 3.2.4.

3.2.7 Voltage Control – VCG

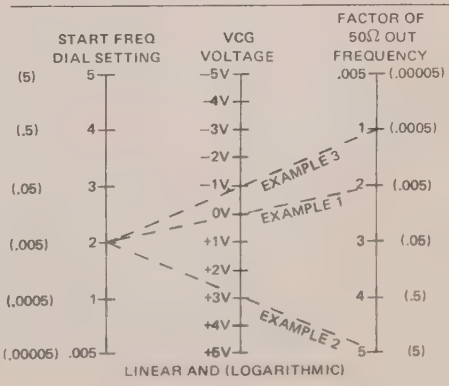
Operation with voltage control can be done in any mode but is usually done in continuous mode; the frequency within a particular range is additionally controlled with dc levels within ±5V, injected at the VCG IN connector. Perform the steps given in paragraph 3.2.2, only set the frequency dial to determine a reference from which the frequency is to be voltage controlled:

1. For frequency control with positive dc inputs at VCG IN, set the dial for a lower limit from which frequency is to be increased.

2. For frequency control with negative dc inputs at VCG IN, set the dial for an upper limit from which frequency is to be decreased.

3. For modulation with an ac input at VCG IN, set the dial at the desired center frequency. Do not exceed the maximum dynamic range of the selected frequency range.

Figure 3-9 is a nomograph with examples of the frequency dial effect as a reference for VCG IN voltages. Example 1 shows that with 0V VCG input (2nd column), frequency (3rd column) is as determined by the frequency dial setting of 2 (1st column). Example 2 shows that with a positive VCG input, output frequency is increased. Example 3 shows



NOTE

The FREQ VERNIER must be rotated full ccw for 1000:1 linear range. Leave the FREQ VERNIER on CAL for 100,000:1 logarithmic range.

Figure 3-9. VCG Voltage-to-Frequency Nomograph

that with a negative VCG input, output frequency is decreased. (Note that the Factor of 50Ω OUT Frequency column must be multiplied by the frequency range in order to give the actual 50Ω OUT frequency.) For full 1000:1 linear mode VCG sweep of the generator frequencies, set the FREQ VERNIER full ccw.

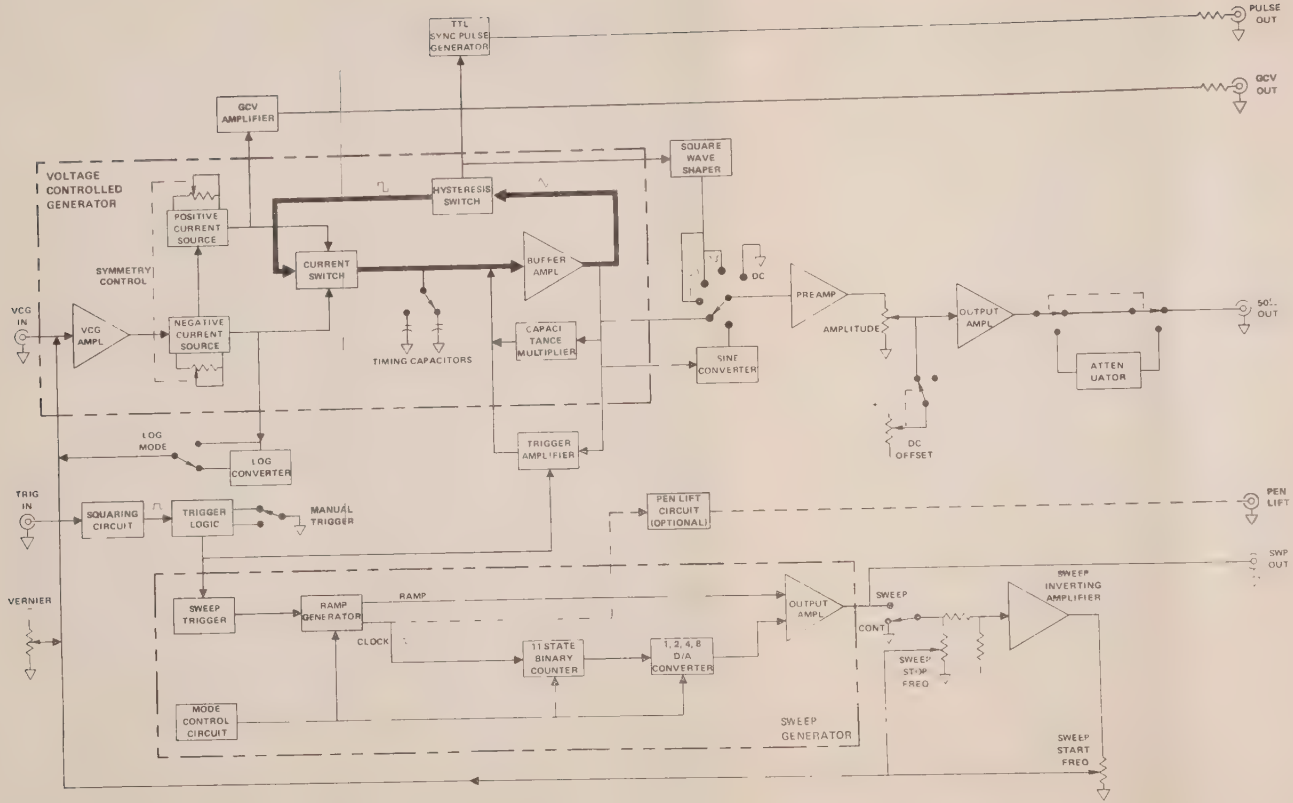


Figure 4-1. Simplified Block Diagram

SECTION 4
CIRCUIT DESCRIPTION

4.1 VOLTAGE CONTROLLED GENERATOR

The heart of the generator consists of the positive and negative current sources, the current switch, timing capacitors, triangle amplifier, and hysteresis switch (figure 4-1).

The positive and negative current sources generate equal but opposite polarity currents which charge and discharge the timing capacitor selected by the range selector. The current switch, which is controlled by the hysteresis switch, selects either the positive or the negative current as the input to the capacitor. Since the capacitor is being charged by a current source which changes polarity periodically, the voltage across the capacitor forms a triangle waveform. This waveform is fed through the triangle buffer amplifier to the hysteresis switch. The hysteresis switch determines when the triangle waveform reaches predetermined positive and negative peak values. When this occurs, the output of the hysteresis changes state and causes the current switch to select the opposite polarity current. The output of the hysteresis switch is a square wave whose edges correspond to the triangle peak values.

The magnitude of the current produced by the current sources is dependent upon the output of the VCG amplifier. By varying the output of the VCG amplifier, the frequency of the triangle and square waveforms may be controlled.

In order to generate sine waves, the triangle waveform is sine shaped in the sine converter circuit with nonlinear elements. The waveform switch selects the waveform of interest and a portion of the signal is selected by the amplitude potentiometer and applied to the output amplifier. The output amplifier is capable of driving a 50Ω load and may be dc offset. The amplifier output is routed to a 50Ω attenuator which can provide 60 dB of attenuation in 20 dB steps. An additional 20 dB of attenuation can be obtained from the amplitude control.

The square wave from the hysteresis switch is also applied to the TTL sync pulse generator, whose square wave output is TTL compatible.

To change frequency ranges, different timing capacitors may be selected by the frequency range switch. On the very slow frequencies the capacitance multiplier becomes active. This circuit senses the capacitor charging current and then subtracts a certain percentage of it from the capacitor. As a result, the capacitor does not charge as fast, and the frequency, as a result, is lower.

Several things can affect the frequency of the generator by varying the output of the VCG amplifier. One is the start frequency dial of the function generator (also called the sweep start frequency dial). When the generator is in the continuous mode, the sweep inverting amplifier generates a positive reference voltage which is applied to the start frequency potentiometer. A percentage of this voltage is applied to the VCG amplifier as an input. In addition to the frequency dial, the frequency vernier feeds in a voltage to the VCG amplifier. The range of the vernier is approximately 1% of the full scale frequency. Finally, an external voltage applied to the VCG input can control the frequency of the generator loop. The VCG input allows frequency modulation of the generator by an external signal.

A log converter can be switched into the feedback loop from the negative current source to the VCG amplifier. This log converter forces the current generators to generate currents that are logarithmically related to the VCG input signal. The relationship is approximately one decade of current change per volt of VCG input change.

Under normal conditions the generator loop runs with the positive and negative current sources balanced. This results in symmetrical sine, triangle and square waveforms, or in the case of the square waveform, a duty cycle of 50%. By varying the symmetry control, the current sources may be unbalanced which results in the generation of asymmetrical waveforms. This allows the generation of pulses, ramps, and other waveshapes.

In the trigger mode, the generator is stopped by the trigger amplifier. This amplifier compares the output of the triangle amplifier to ground. Its output draws just the right amount of current away from the capacitor to keep it at zero volts. This level is known as the trigger baseline. When an external signal is applied to the trigger input, it is shaped into a fast rise time pulse by the squaring circuit and is applied to the trigger logic circuit. This circuit in turn shuts off the trigger amplifier for one cycle of the output waveform. Trigger input may also be made manually by the manual trigger switch.

The trigger logic circuit also allows the generator to run in the gated mode. In this mode the generator will run as long as the trigger input signal is positive. When it goes negative, the generator will continue to run until the last cycle is complete and then remain at the trigger baseline level.

Either linear ramp sweep or a 10 step staircase waveform may be selected as the sweep signal. The sweep signal is then applied to the sweep stop frequency dial. It is also inverted and offset by the sweep inverting amplifier and applied to the sweep start frequency dial. By summing these two signals in the VCG amplifier, the sweeping start and stop frequency limits are independently controlled. Depending on the dial settings, sweeping may be in either direction; i.e., up or down in frequency.

The sweep generator in the 185 can be operated either in the continuous or triggered mode. When triggered, either a single ramp or a single step is generated each time a trigger pulse is present. A sweep output signal can drive X-Y recorders or other devices.

The GCV output is an analog output voltage proportional to the instantaneous output frequency of the generator. This is from the GCV amplifier which senses the positive current source output and generates a voltage proportional to the current.

4.2 SWEEP GENERATOR

A variable rate ramp generator is the main element of the sweep generator. The ramp generator may operate either continuously, or in a triggered mode. In the triggered mode, a single ramp cycle is generated each time a trigger input pulse is received from the trigger circuit. An output amplifier provides signal insertion and precise zero level of the ramp signal.

The pulse output of the ramp generator drives an 11-state binary counter and an optional pen lift circuit. The pen lift circuit provides a pen lift signal for an external X-Y recorder.

The 11-state binary counter drives a binary weighted D/A converter. The output amplifier acts as a summing amplifier for the D/A converter whose output is a staircase waveform.

The mode control circuit has control of all the circuit blocks and is used to control sweep generator modes.

SECTION 5
CALIBRATION

5.1 FACTORY REPAIR

Wavetek maintains a factory repair department for those customers not possessing the necessary personnel or test equipment to maintain the instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached to minimize turnaround time.

5.2 REQUIRED TEST EQUIPMENT

Spectrum Analyzer . . . . . 600 kHz to 5 MHz
Voltmeter . Microvolt dc measurement (0.01% accuracy)
Oscilloscope, Dual Channel . . . 150 MHz bandwidth
Distortion Analyzer . . . . . To 600 kHz
Counter . . . . . To 1 MHz (0.1% accuracy)
50Ω Load . . . . . ±0.1% accuracy

5.3 REMOVING GENERATOR COVER

For main circuit board access, invert the instrument, remove the four screws in the cover, and lift off the bottom cover.

5.4 CALIBRATION

After referring to the following preliminary data, perform calibration, as necessary, per table 5-1. If performing partial calibration, check previous settings and adjustments for applicability.

1. Unless otherwise noted, all measurements made at the 50Ω OUT connector should be terminated into a 50Ω (±0.1%) load.

2. Test Points (TPs) and adjustments are on the main board unless noted otherwise.

3. Before connecting the unit to an ac source, check the ac line circuit to make sure the 115/230 and HI/LO switches are set at the correct position (see paragraph 2.2).

4. Start the calibration by setting the front panel switches as follows:

FREQ Range . . . . . X 10K
START FREQ 5
FREQ VERNIER . . . . . CAL
SYMMETRY . . . . . NORMAL
GEN MODE . . . . . CONT (LIN)
WAVEFORM . . . . . ⎍ (No Offset)
AMPLITUDE 0
AMPLITUDE VARIABLE . . . . . Max cw
SWEEP MODE . . . . . SWEEP START
SWEEP TIME . . . . . OFF

5. Allow the unit to warm up at least 30 minutes for final calibration.

Table 5-1. Calibration Chart

Step	Check	Tester	Cal Points	Control Settings	Adjust	Desired Results	Remarks
1	Power Supply Regulators	Voltmeter	C84 (+)	–	R206	+15 Vdc ±50 mV	Ground is C84 (–).
2			C88 (–)			–15 Vdc ±150 mV	
3			C80 (+)			+5V ±250 mV	
Cover the instrument and allow a 30 minute warm-up. Keep covered as much as possible during calibration.							
4	Amplifier Offset	Voltmeter	Q19 emitter	GEN MODE: TRIG (LIN) WAVEFORM: ∿	R192	0V ±5 mV	∿ amplifier output.

Table 5-1. Calibration Chart (Continued)

Step	Check	Tester	Cal Points	Control Settings	Adjust	Desired Results	Remarks
5	Amplifier Offset	Voltmeter	50Ω OUT		R124	0V ± 10mV	
6				AMPLITUDE VARIABLE: max ccw	R156		Repeat steps 5 and 6
7	Time Symmetry	Dual channel scope		GEN MODE: CONT (LIN) WAVEFORM: ⊓ FREQ: X 1K Dial: 5 Scope time base: 20 μs/div	R32	Time symmetry < 0.1%	Follow procedure in figure 5-1.
8				FREQ: X 100K Dial: .05	R35		Follow procedure in figure 5-1.
9							Repeat steps 6 and 7.
10	VCG Zero			Same as for step 7	R13	Minimum frequency shift while shorting and opening VCG IN BNC to ground	
11	Sine Distortion	Distortion analyzer (with 50Ω termination)		FREQ: X 1K VERNIER: CAL Dial: 5 WAVEFORM: ∿	R68, R71	Distortion < 0.16%	If minimum distortion cannot be met, refer to table 6-1.
12				Dial: 1		Distortion < 0.2%	If adjustment was necessary, repeat step 10.
13				FREQ: X 10K			
14	High Freq Sine Distortion			FREQ: X 1M Dial: 1 WAVEFORM: ⊓	C64	Minimum rise time with minimum overshoot	
15		Spectrum analyzer		WAVEFORM: ∿	None	All harmonics below −32 dB from 1 to 5 MHz	If not, refer to table 6-1.
16	Frequency	Counter		WAVEFORM: ⊓ FREQ: X 10K Dial: 5	R21	50 kHz ±100 Hz	
17				FREQ: X 1M	C22	5 MHz ±20 kHz	Repeat steps 15 and 16.
18				FREQ: X 100K	C17	500 ±1 kHz	Change C16 if necessary

Table 5-1. Calibration Chart (Continued)

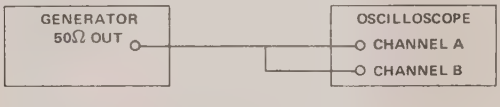
Step	Check	Tester	Cal Points	Control Settings	Adjust	Desired Results	Remarks
19	Frequency	Counter	50Ω OUT	FREQ: X 100	None	500 ±10 Hz	
20				FREQ: X 1K		5 kHz ±100 Hz	
21				FREQ: X 10K		50 ±1 kHz	
22	Time Symmetry	Dual channel scope		FREQ: X 10 Scope time base: 0.1s/div	R92	Time symmetry < 0.1%	Follow procedure in figure 5-1.
23	Frequency	Counter		Dial: 5	R88	50 ±0.1 Hz or 20 ms ±40 μs	Change R87 if necessary.
24				FREQ: X .001	None	5 MHz ± 0.3 mHz 189s to 217s.	
25				FREQ: X .01		.05 Hz ± 1 mHz or 20s ± 400ms	
26				FREQ: X .1		0.5 Hz ± 10mHz or 2s ± 40ms	
27				FREQ: X 1		5 Hz ± 100mHz or 0.2s ± 4ms	
28				FREQ: X 1K Dial: 5, 4, 3, 2, 1, .5		Dialed Freq ±100 Hz	
29				FREQ: X 1M Dial: .5, 1, 2, 3, 4, 5		Dialed Freq ± 100kHz	
30		Oscilloscope		FREQ: X 10K START FREQ: .5 inner scale. GEN MODE: CONT (LOG)	R26	5 kHz ±50 Hz	

Remove the four screws attaching the main board to the long standoffs. Put the bottom cover on, but do not insert the screws. Place the instrument on its feet and remove the top cover for sweep board access. Steps 32 and 33 will require a similar maneuver for component access.

31	Sweep	Oscilloscope	50Ω OUT	FREQ: X 1K SWEEP MODE: SWEEP STOP STOP FREQ: 5 START FREQ: max cw	Sweep board R51	5 kHz ±10 Hz	

Table 5-1 Calibration Chart (Continued)

Step	Check	Tester	Cal Points	Control Settings	Adjust	Desired Results	Remarks
32	Sweep	Oscilloscope	50Ω OUT	No change	Main board R3	Minimum frequency shift while rotating START FREQ dial thruout range	Repeat step 30.
33			SWP OUT	SWEEP TIME: 10 ms ▮ 1 ms SWEEP TIME VARIABLE: full ccw	Sweep board R12	SWEEP STOP amplitude = CONT RAMP amplitude ±10 mV	Switch SWEEP MODE to ensure results.



1. ADJUST OSCILLOSCOPE.

   TRIGGER: INTERNAL AND ALTERNATE
   CHANNEL A: NORMAL
   CHANNEL B: INVERTED

2. ADJUST START FREQ/VERNIER FOR ONE CYCLE ON SCOPE.

3. SWITCH X 10 SWEEP MAGNIFIER ON.

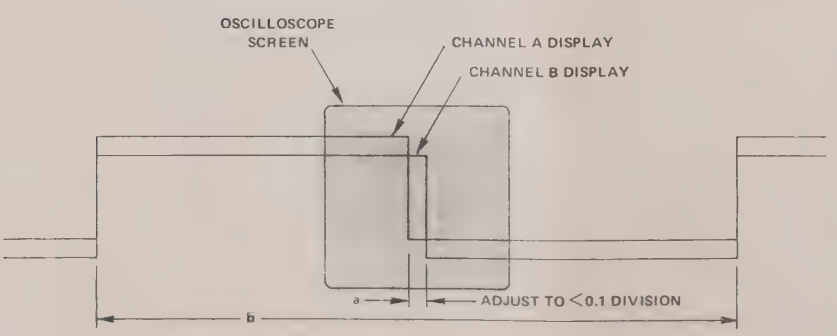


Figure 5-1. Time Symmetry Measurement

SECTION 6
TROUBLESHOOTING

6.1 INTRODUCTION

This section is organized as follows:

Circuit Board Access
Basic Techniques
Troubleshooting Individual Components
Troubleshooting Guide

(Refer to paragraph 5.2 for required test equipment.)

NOTE

Wavetek maintains a factory repair department for those customers not possessing the necessary personnel or test equipment to maintain the instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached to minimize turnaround time.

6.2 CIRCUIT BOARD ACCESS

Turn the instrument over, remove the four screws in the bottom cover and remove the bottom cover. For sweep board access, remove the four screws holding the main board to its long standoffs, place the instrument right side up and remove the top cover.

6.3 BASIC TECHNIQUES

Troubleshooting requires no special technique. Listed below are a few reminders of basic electronic fault isolation.

1. Check control settings carefully. Many times a seemingly malfunction is an incorrect control setting, or a knob that has loosened on its shaft.

2. Check associated equipment connections. Make sure that all connections are securely connected to the correct connector.

3. Perform the calibration procedure. Many out-of-specification indications can be corrected by performing specific calibration procedures.

4. Visually check the interior of the instrument. Look for such indications as broken wires, charred components, and loose leads.

6.4 TROUBLESHOOTING INDIVIDUAL COMPONENTS

6.4.1 Transistor

A transistor is defective if more than one volt is measured across its base emitter junction in the forward direction.

A transistor when used as a switch may have a few volts reverse bias voltage.

If the collector and emitter voltages are the same; but the base emitter voltage is less than 500 mV forward voltage (or reversed bias), the transistor is defective.

A transistor is defective if its base current is larger than 10% of its emitter current (calculate currents from voltage across the base and emitter series resistors).

6.4.2 Diode

A diode is defective if there is greater than 1 volt (typically 0.7 volt) forward voltage across it (except Zener and LED).

6.4.3 Operational Amplifier

The "+" and "−" inputs of an operational amplifier will have less than 15 mV voltage difference when operating under normal conditions.

If the output voltage stays at maximum positive, its "+" input voltage should be more positive than its "−" input voltage, or vice versa; otherwise, the operational amplifier is defective.

6.4.4 FET Transistor

No gate current should be drawn by the gate of an FET transistor. If so, the transistor is defective.

The gate-to-source voltage is always reverse biased under a normal operating condition; e.g., the source voltage is more positive than the gate voltage for 2N5485, and the source

voltage is more negative than gate voltage for a 2N5462. Otherwise, the FET is defective.

6.4.5 Capacitor

Shorted capacitors have zero volts across their terminals.

Opened capacitor can be located (but not always) by using a good capacitor connected in parallel with the capacitor under test and observing the resulting effect.

6.5 TROUBLESHOOTING GUIDE

Table 6-1 provides a list of possible malfunction symptoms, their probable causes, and the prescribed remedies. Localize the fault to a specific stage by checking the parameters given for the test points. Then check the dc operating voltages at the pins of solid-state devices. Check associated passive elements with a high input impedance ohmmeter (power off) before replacing a suspected semiconductor element.

Table 6-1. Troubleshooting Guide

Symptom	Corrective Procedures
POWER SUPPLY PROBLEM	
Blown fuse	1. Check that the HI/LO and 115/230 switches at the rear panel are set correctly. (Refer to paragraph 2.2.) 2. Replace fuse; if fuse blows again, refer to the following steps. 3. Examine circuit boards and wiring for source of short circuit. 4. Use an ohmmeter to detect possible short circuits between power supply and ground and between individual power supplies. 5. Isolate each part of the circuit by unplugging the sweep board and unsoldering the jumpers along the power supply path. Plug in the sweep board and replace the jumpers one-by-one to isolate the overloading circuit. Frequently, a shorted capacitor is the problem.
±15V supply voltage below normal	Isolate the power supply from most of the generator circuits by unsoldering the two jumpers near the "+" end of C81 on the main circuit board. If supply voltage returns to normal, there is an extra loading current from a generator circuit; otherwise, troubleshoot the power supply circuitry.
±15V supply voltage above normal	Power supply circuit malfunction.
+5V regulator voltage abnormal	Isolate the regulator from generator circuits by unsoldering any leads at E15, E16 and E17. If regulator voltage returns to normal, there is an extra loading current from a generator circuit; otherwise, the trouble is in the regulator. Replace IC10.
Index (lighted indicator) on front panel abnormally bright or dim	HI/LO switch at the rear panel is not set correctly. (Refer to paragraph 2.2.)
OUTPUT WAVEFORM PROBLEM	
No output waveform at 50Ω OUT and PULSE OUT (GEN MODE at CONT)	1. Ensure power supply voltages are normal. 2. Temporarily remove Q44 on main board. If generator runs, problem is in the trigger and gate logic circuit. Otherwise, trouble is in the generator loop.

Table 6-1. Troubleshooting Guide (Continued)

Symptom	Corrective Procedures
No output waveform at 50Ω OUT, but PULSE OUT normal, or all waveforms greatly distorted	Set the AMPLITUDE VARIABLE full ccw and set WAVEFORM to DC. If the output voltage at 50Ω OUT can be adjusted to ±10V into open circuit with the DC OFFSET control, the problem is in the preamplifier; otherwise, check the output amplifier.
Both waveform amplitude and frequency jittering	1. Power supply out of regulation due to ac line voltage being too low. Check line voltage. Make sure the HI/LO switch setting on rear panel is correct. (Refer to paragraph 2.2.) 2. Power supply malfunction. (Refer to Power Supply Problem.)
Distorted sine and square waveforms, but triangle waveform normal	Sine converter and square shaper malfunction. Check for defective diode. *NOTE* *If a diode is bad, the entire set of eight diodes should be replaced with a new matched set, or select a diode that gives minimum sine distortion at 1 kHz.*
Half of sine and square waveforms missing	1. Defective diodes CR17 or CR21. 2. Defective switch wafer or loose contact of SW3-A and SW3-B.
Distorted triangle and sine waveforms at one particular frequency range	1. Check for defective timing capacitor of the range (C15 thru C23). 2. Check C8 thru C10, C13, C25 and C94, if distortion shown at X 1 MHz range.
Distorted waveform or generator not running when X .001 Hz thru X 10 Hz selected	Capacitance multiplier malfunction.
Sine distortion out of specification at frequency below 500 kHz	1. Square wave time symmetry is not calibrated correctly. 2. Defective component in sine converter and square shaper. *NOTE* *If a diode is bad, the entire set of eight diodes should be replaced with a new matched set, or select a diode that gives minimum sine distortion at 1 kHz.* 3. Resistor R109, R111, R112 or R114 is out of tolerance. Connect 10 kΩ trim potentiometers in locations marked R111 and R112. Adjust the two trim potentiometers and also R68 and R71 to obtain less than 0.16% distortion. Remove the potentiometers, measure the resistance and replace with standard 1/8W resistors. If 0.16% distortion still cannot be achieved, remove both R110 and R113 and connect a 500Ω trim potentiometer in each location. Adjust the two trim potentiometers R68 and R71 for less than 0.16% distortion. Replace potentiometers with standard 1/8W resistors. 4. If sine distortion is OK at 1 kHz, but out of specification at 10 kHz, check for defective C31, C32, C38, Q6 and Q14.

Table 6-1. Troubleshooting Guide (Continued)

Symptom	Corrective Procedures
Sine distortion out of specification at frequency greater than 500 kHz	1. Check square wave for slow rise/fall time. If so, check for defective capacitor in the preamplifier and output amplifier. 2. Frequency dial accuracy and sine distortion problems at X 1M range are due to the excess peaking or roll-off of the triangle waveform. Capacitors C28 and C35, also C29 and C34, need to be selected for maximum flatness of the triangle peak voltages at emitter of Q19. To check the flatness of the triangle peak voltage, a high frequency oscilloscope and a X 10 scope probe (> 150 MHz bandwidth) should be used. The oscilloscope probe should be correctly compensated and its ground lead length should keep to minimum. 3. If triangle is distorted, check for defective capacitors C8 thru C10, C13, C25 and C94. 4. Check for defective diodes CR10 or CR11.
TIME SYMMETRY PROBLEM	
Positive slope of triangle remains constant when frequency dial varied	1. Defective Q5, Q6, C9, IC3 and associated circuitry. 2. Defective Q9 thru Q12 and CR6 thru CR9.
Negative slope of triangle remains constant when frequency dial varied	1. Defective IC3 and associated circuitry. 2. Defective Q9 thru Q12 and CR6 thru CR9.
Symmetry cannot be adjusted to specification	Defective Q6, Q14, R33, R34, R40 and R41.
Symmetry worse at low frequency end of dial	Check for high leakage components Q6, Q9 thru Q12 and Q14.
Symmetry out of specification at X 10 frequency range or below	Defective IC6 and associated circuitry.
FREQUENCY ACCURACY PROBLEM	
Frequency accuracy out of specification at X 1 kHz range	1. Mismatched dial and potentiometer, if frequency is out of specification at the same portion of the dial in every range. Ensure that the number or the back of the dial matches the number on the potentiometer. 2. Defective dial potentiometer. 3. VCG amplifier (IC2) or current source (IC3) is saturated when frequency dial is set to the top (5.0). Check for defective Q1, Q6, IC2 and associated circuitry.
Frequency accuracy out of specification at X 10K and X 100 kHz ranges	Check for defective C30 thru C33, C38 and R61 thru R66.
Frequency accuracy out of specification at X 1 MHz range	Check for defective C25, C28, C29, C34, C35, R60, R67, CR10 and CR11

Table 6-1. Troubleshooting Guide (Continued)

Symptom	Corrective Procedures
Frequency accuracy out of specification at X .001 to X 10 Hz ranges	1. R90 and R94 thru R96 are mismatched. Defective R97. 2. Defective IC5, IC6 and associated circuitry. 3. If triangle is distorted when dial is set to the top (5.0), defective regulator Q22 and Q23.
MODE OF OPERATION PROBLEM	
Output not in agreement with GEN MODE switch setting	Trigger and gate logic circuit or IC8 malfunction.
Generator running in trigger or gated mode	If voltage at pin 11 of IC8 is 0 to 0.4V (logic zero) when TRIG mode is selected, the problem is in the trigger amplifier (Q42 thru Q45). Otherwise, troubleshoot IC8, IC9 and associated circuitry.
Generator can be triggered by operating MAN TRIG switch, but not by external signal	Squaring circuit malfunction.
LOG CONVERTER PROBLEM	
Frequency varies much less than 5 decades when varying the dial with log frequency selected	1. Defective R18 and R225 in the log converter. 2. Defective Q2, Q3 and associated components.
Frequency jittering when log frequency selected	Defective R28 and C7 in the log converter.
FREQUENCY SWEEP PROBLEM (Unless otherwise specified, all components on sweep board)	
STOP FREQ dial accuracy out of specification	1. If the 11-state counter is not set at the 11th step, it is malfunctioning. 2. If the amplifier output (junction of CR11 and R53) is not at its maximum (+7.5V approximately), the D/A converter or output amplifier is malfunctioning. 3. Sweep inverting amplifier on main board is malfunctioning; its gain should be −1. 4. Defective dial potentiometer or mismatched dial and potentiometer.
Generator frequency not sweeping and no ramp signal output at SWP OUT(GEN MODE at SWEEP and SWEEP MODE at CONT RAMP)	1. If voltage at pin 9 of IC2 is not 0V, IC6, R9, R14, C1 or SW2-A defective. 2. If ramp signal is not seen at pin 6 of IC1, ramp generator malfunctioning; otherwise, problem is in IC3.

Table 6-1. Troubleshooting Guide (Continued)

Symptom	Corrective Procedures
Generator frequency not stepping and no staircase signal at SWP OUT (SWEEP MODE at CONT STEP)	1. If no clock pulse is seen at pin 3 of IC4 in the 11-state counter, the ramp generator is not running. 2. IC4 or IC6 is malfunctioning.
Number of steps at SWP OUT not 10	IC4, IC5, IC6 or 11-state counter is malfunctioning.
Staircase missing step or looks as if steps are random	D/A converter Q10 thru Q13 is malfunctioning.
Main generator output not oscillating at stop frequency as indicated by STOP FREQ dial (SWEEP MODE at SWEEP STOP)	Q8 is defective.

SECTION 7
PARTS AND SCHEMATICS

7.1 DRAWINGS

The following assembly drawings (with parts lists) and schematics are in the arrangement shown below.

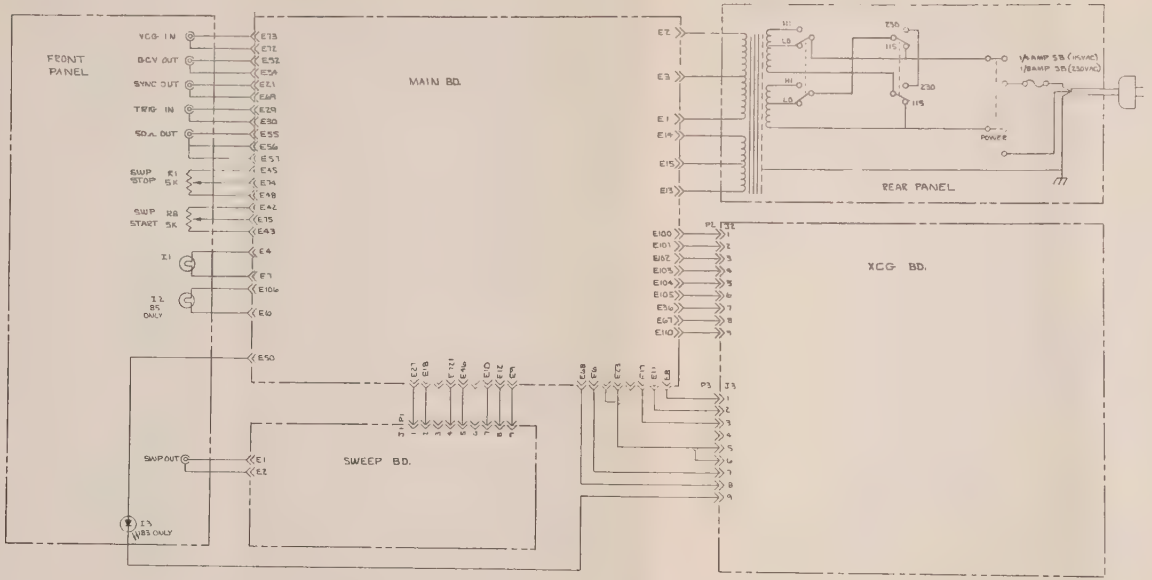
7.2 ORDERING PARTS

When ordering spare parts, please specify part number, circuit reference, board, serial number of unit, and if applicable, the function performed.

7.3 ADDENDA

Under Wavetek's product improvement program, the latest electronic designs and circuits are incorporated into each Wavetek instrument as quickly as development and testing permit. Because of the time needed to compose and print instruction manuals, it is not always possible to include the most recent changes in the initial printing. Whenever this occurs, addendum pages are prepared to summarize the changes made and are inserted immediately inside the rear cover. If no such pages exist, the manual is correct as printed.

	Page No.
CHASSIS	
Schematic	7-2
Assembly Drawing	7-3
Parts List	7-4
MAIN BOARD	
Schematic	7-5
Assembly Drawing	7-8
Parts List	7-10
SWEEP BOARD	
Schematic	7-12
Assembly Drawing	7-13
Parts List	7-14



WAVETEK

CHASSIS SCHEMATIC

7-2

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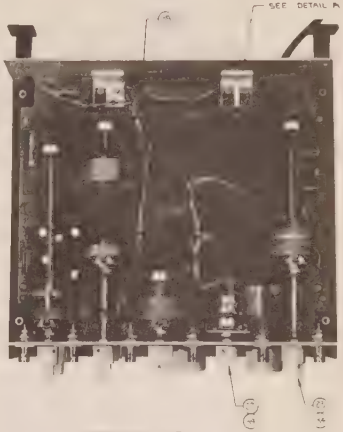
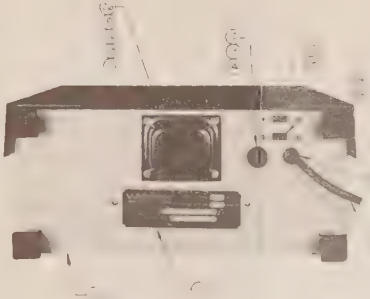
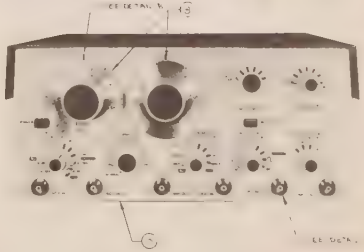
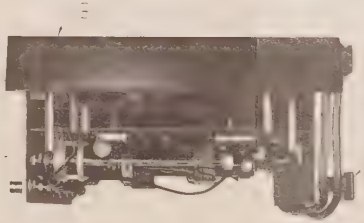
DETAIL H





DETAIL B





DETAIL C

		WAVETEK	
		CHASSIS ASSEMBLY	
		SIZE A	000-0058
		SCALE	REV
		23338	

7-3

ITEM NO	REF DESIG	DESCRIPTION	MFGR PART NO.	MFGR	WAVETEK PART/STOCK NO	QTY	STATION NO	PREP NO
1		CHASSIS SCHEMATIC		WVTK	000-00-0000	1		
2		REAR PANEL	187-101	WVTK	1400-00-5135	1		
3		FRONT PANEL	187-102	WVTK	1400-00-5140	1		
4		LASL (TOP)	180-302-1	WVTK	1400-00-5060	1		
5		CASE (BOTTOM)	180-302-2	WVTK	1400-00-5050	1		
6		EXTENDER (SIDE)	180-301	WVTK	1400-00-5070	2		
7		POST (FEET)	180-302	WVTK	1400-00-5020	4		
8		DIAL ASSEMBLY		WVTK	1201-00-0024	1		
9		BAIL KIT	180-240	WVTK	2600-08-0010	1		
10		END BELL TRANSFORMER	110-333	WVTK	1400-00-0174	1		
11		NAME PLATE (STD)	180-318	WVTK	1400-00-5190	1		
12		FUSE 115V	313-250	LTLFUSE	2400-05-0008	1		
13		FUSE 230V	313-125	LTLFUSE	2400-05-0001	1		
14		FUSE HOLDER	345001	LTLFUSE	2400-05-0012	1		
15		POWER CORD	17237	BELDEN	6000-80-0001	1		
16		FASTENER (FEET)	C7494-632-4	TINN	2800-09-0003	6		
17		LAMP	328/40	MDWA	2400-07-0013	2		
18		CONNECTOR BNC	KC7946	KING	2100-01-0002	6		
19		SHOULDER WASHER (NYLON)	2668	SMITH	2800-27-0004	12		
20		SOLDER LUG	1497	SMITH	2100-04-0012	6		
21		KNOB (STD)	RB-67-1-S8-M	ROGAN	2400-01-0048	2		
22		KNOB SET (COAX)	RB-67-1-S8-0-M-9	ROGAN	2400-01-0089	5		
24		SWITCH HI-LO W/SOLDER GUARD	SW422-FT-MK	UID	3105-00-0001	1		
25		SWITCH AC	4823-6LF	UID	3105-00-0002	1		
26		TRANSFORMER	5600-00-0022	WVTK	5600-00-0022	1		
27		#6 SOLDER LUG	1414-6	SMITH	2100-04-0009	3		
28		POP RIVET	4X580	DAYTON		4		
29		BUSHING (STRAIN RELIEF)	SR3P-4	HEYCO	2800-00-0015	7		
30								
31		STAND OFF	1475-M03-F05-812	UNICORP		4		
32		STAND OFF	1495-M03-F05-440	UNICORP		4		

WAVETEK® PARTS LIST — TITLE CHASSIS ASSEMBLY — MODEL 185 — DRAWN BY B ADKINS — APPROVAL — NO. 185-000 1101-00-0058 — REV — SH 1 OF 3

Form 102

ITEM NO	REF DESIG	DESCRIPTION	MFGR PART NO	MFGR	WAVETEK PART/STOCK NO	QTY	STATION NO	PREP NO
34		SOLDER LUG	1419-6		100-01-0002	7		
35		MOUNTING, NYLON	4829		1100-00-2180	1		
36		MAGNETIC LOAD	119-305	WVTK	1400-00-4970	2		
37		DIAL INDICATOR	180-303	WVTK	1400-00-5400	1		
38		POWER CORD HOLDER		WVTK	1400-00-5060	1		
39		EMPTY S ASSY		WVTK	1202 00-0058	1		
40		CABLE TIPS	TYN-23M-6	M & B	2800-00-0006	AR		
41		POWER SWITCH		WVTK	3103-00-0020	1		
42		SHRINK TUBING	FIT-221-1/8	ECC	6001-20-2000			
43		SHRINK TUBING	FIT-221-3/16	ECC	6001-20-3000			
44		SHRINK TUBING	FP-301-1/2	ECC	6001-20-8000			
45		WIRE, BLACK			6000-32-2000			
46		WIRE, BROWN			6000-32-2001			
47		WIRE, RED			6000-32-2002			
48		WIRE, ORANGE			6000-32-2003			
49		WIRE, GREEN			6000-32-2005			
50		WIRE, BLUE			6000-32-2006			
51		WIRE, VIOLET			6000-32-2007			
52		WIRE, GREY			6000-32-2008			
53		WIRE, WHITE			6000-32-2009			
54		WIRE, WHT/BRN			6000-32-2091			
55		WIRE, WHT/RED			6000-32-2092			
56		WIRE, WHT/ORANGE			6000-32-2093			
57		WIRE, WHT/YELLOW			6000-32-2094			
58		WIRE, WHT/BLUE			6000-32 2096			
59		WIRE, WHT/VIOLET			6000-32-2097			
60		WIRE, WHT/GREY			6000-32-2098			
61		WIRE, 18 GAUGE BLACK			6000-31-8000			
62		COAX CABLE	RG174U		6001-40-0001			
63		4/40 X 1/4 P.M.				2		
64		4/40 X 3/8 P.M.				4		
65		6/32 X 3/8 P.M. SELF TAPING F				4		
66		6/32 X 1 1/2 PAN HEAD				4		
67		8/32 X 2 BLACK OXIDE P H				8		
68		LOCKWASHER #4 -4-2-2				12		
69		LOCKWASHER #6 -4-4-4-				2		
70		NUT, #4 -2-				2		
71		NUT, #6 -3-						

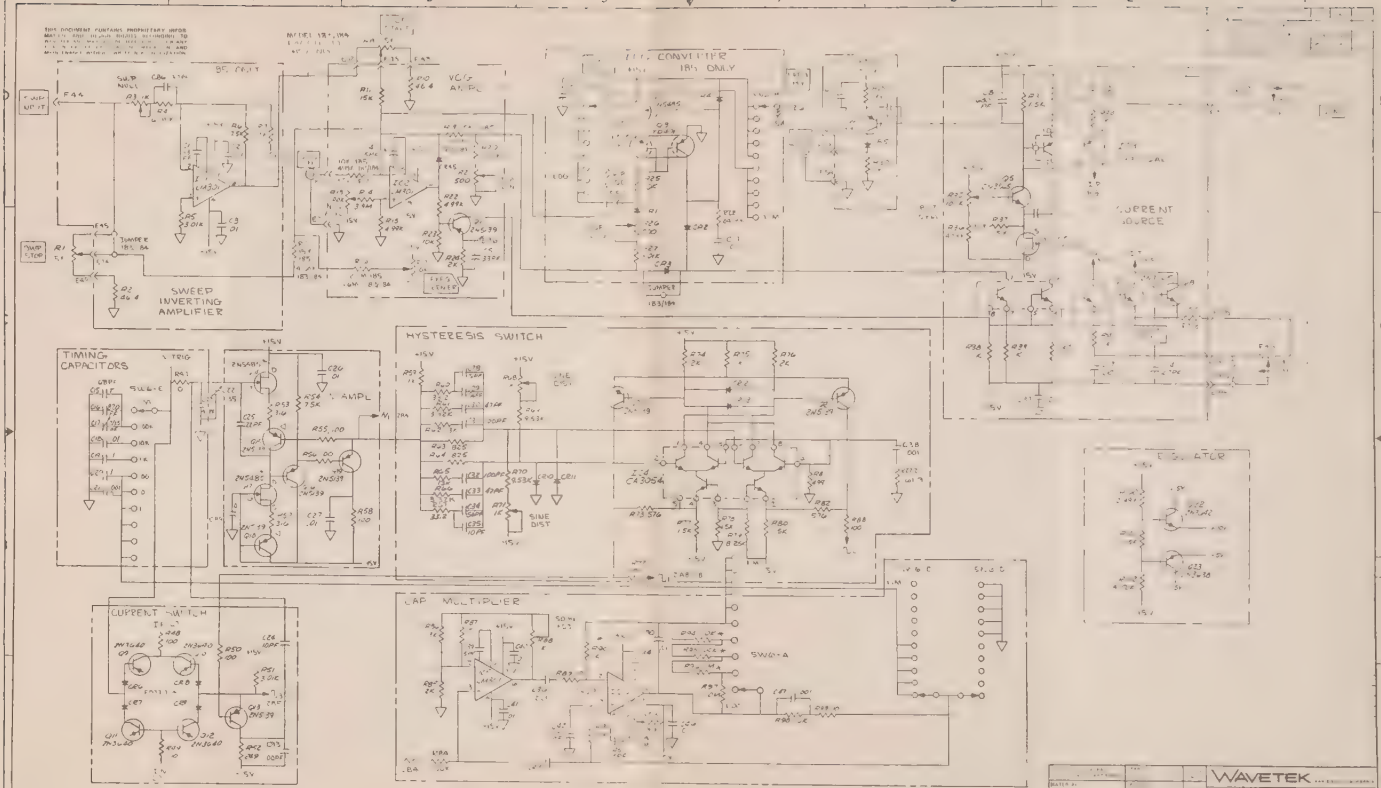
WAVETEK® PARTS LIST — TITLE CHASSIS ASSEMBLY — MODEL 185 — DRAWN BY B ADKINS — APPROVAL — NO. 185-000 1101-00-0058 — REV — SH 2 OF 3

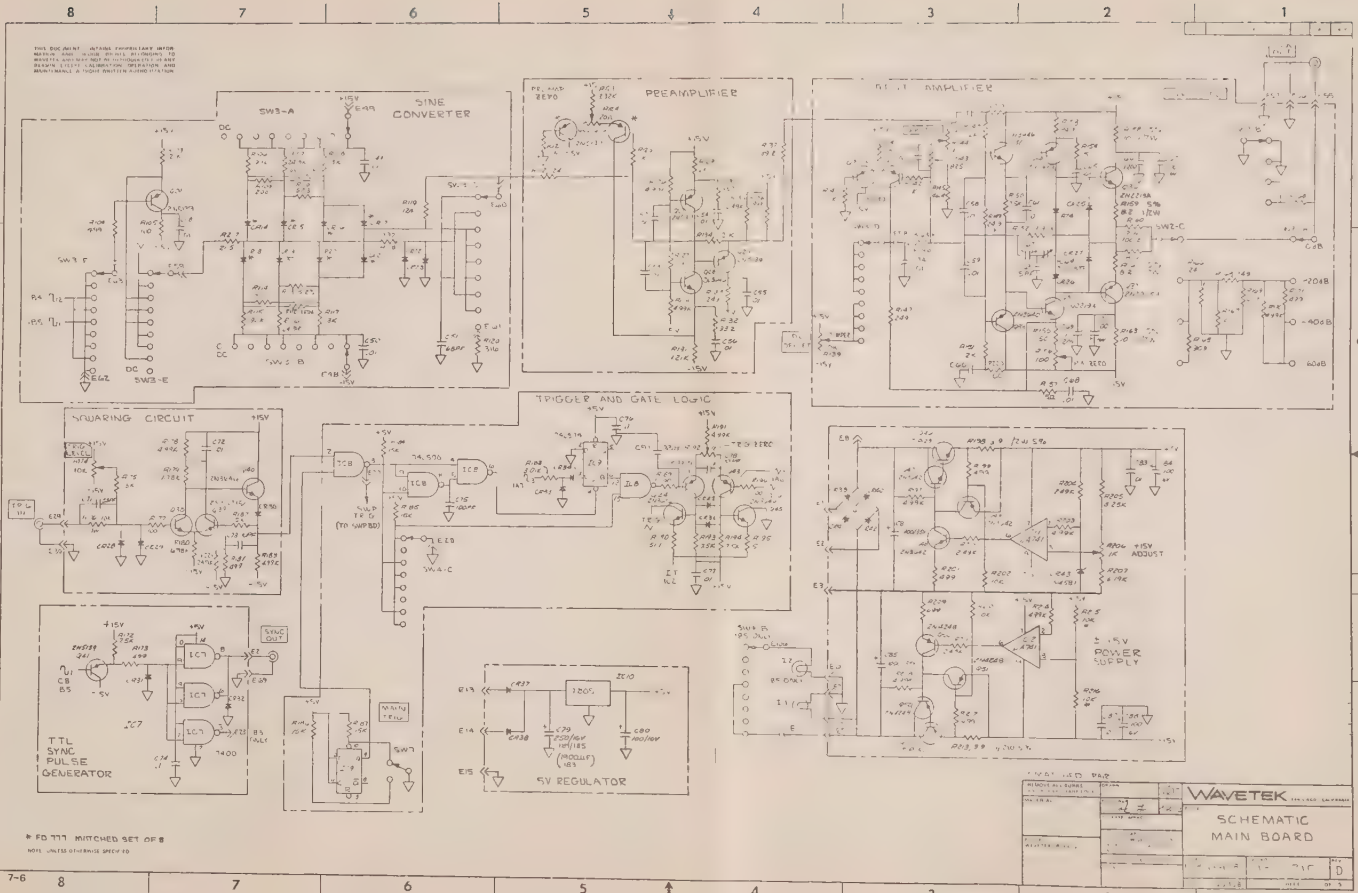
Form 102

ITEM NO	REF DESIG	DESCRIPTION	MFGR PART NO	MFGR	WAVETEK PART/STOCK NO	QTY	STATION NO	PREP NO
72		6/32 X 3/4 P.M.				6		
73		6/32 X 3/8 P.M.				4		
74		AMP PINS (F)				2		

WAVETEK® PARTS LIST — TITLE CHASSIS ASSEMBLY — MODEL 185 — DRAWN BY B ADKINS — APPROVAL — NO 185-000 1101-00-0058 — REV — SH 3 OF 3

Form 102


SWEEP INVERTING AMPLIFIER
V/F CONVERTER (815 ONLY)
CURRENT SOURCE
TIMING CAPACITORS
HYSTERESIS SWITCH
SINE DIST
CURRENT SWITCH
CAP MULTIPLIER
SCHEMATIC MAIN BOARD
WAVETEK
REF DES NOT USED
R138 CR44 C12
E45
LAST REF USED
C94
E425
Q53
CR45
IC12
E90, R94, R95, R96 ARE MATCHED SET
NOTE UNLESS OTHERWISE SPECIFIED R MATCHED PAIR


SINE CONVERTER
PREAMPLIFIER
SQUARING CIRCUIT
TRIGGER AND GATE LOGIC
TTL SYNC PULSE GENERATOR
5V REGULATOR
±15V POWER SUPPLY
WAVETEK
SCHEMATIC MAIN BOARD

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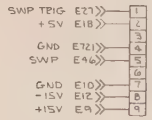
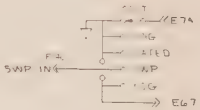
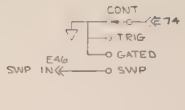


P1 TO SWEEP BD
ALL MODELS



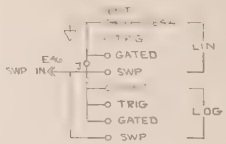
SW4 - A

GEN MODE SWITCH
MODEL 183



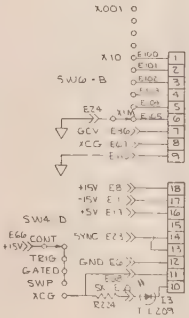
SW4 - A

GEN MODE SWITCH
MODEL 184

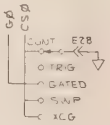


SW4 - A

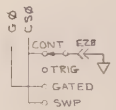
GEN MODE SWITCH
MODEL 185



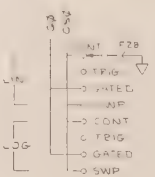
CONNECTORS TO XCG BD
183 ONLY



SW4-C



SW4-C



SW4-C

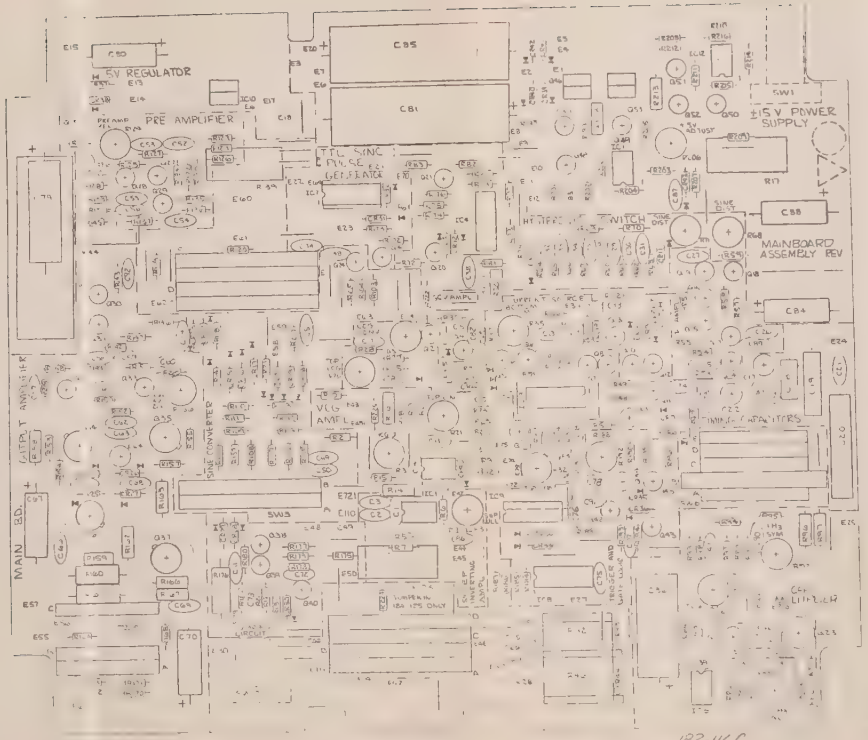
NOTE UNLESS OTHERWISE SPECIFIED

WAVETEK SAN DIEGO, CALIFORNIA

SCHEMATIC
MAIN BOARD

73338

7-7



WAVETEK

SILKSCREEN
ASSEMBLY PRINT
(MAIN BOARD)

7-8

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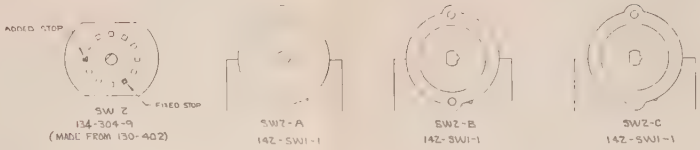


SW 2
134-304-9
(MADE FROM 130-402)

SW2-A
142-SW1-1

SW2-B
142-SW1-1

SW2-C
142-SW1-1

SW3
182-303
(MADE FROM 162-401)

SW3-A
147-400

SW3-B
147-400

SW3-C
147-400

SW3-D
147-400

SW3-E
147-400

SW3-F
147-400

MODEL 185 ONLY

MODEL 184 ONLY

MODEL 183 ONLY

SW4
134-304-15
(MADE FROM 130-403)

SW4
134-304-14
(MADE FROM 130-403)

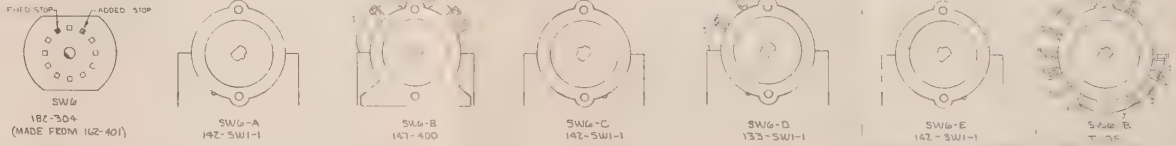
SW4
134-314
(MADE FROM 130-403)

SW4-A
147-400

SW4-B
147-400

SW4-C
147-400

SW4-D
147-400



SW6
182-304
(MADE FROM 162-401)

SW6-A
142-SW1-1

SW6-B
147-400
142-SW1-1
184-ONLY

SW6-C
142-SW1-1

SW6-D
133-SW1-1

SW6-E
142-SW1-1

SW6-B
T-36

2 DETENTS & WAFERS ARE THE SAME FOR ALL MODELS EXCEPT AS INDICATED.

1 ALL DETENTS & WAFERS ARE SHOWN FROM FRONT VIEW IN FULL COUNTER CLOCKWISE POSITION.

NOTE UNLESS OTHERWISE SPECIFIED

WAVETEK

SWITCH DWG
MAIN BOARD

7-9

ITEM NO	REF DESIG	DESCRIPTION		MFGR PART NO	MFGR	WAVETEK PART/STOCK NO	QTY	STATION NO	PREP NO
1		SILKSCREEN ASSEMBLY PRINT			WVTK	4301-01-0126			
2		P. C. BOARD		182-110	WVTK	4700-00-0126	1		
3		SCHEMATIC		182-216	WVTK	4 -03-00 0126			
4		JUMPER			WVTK		50		
5									
6		RESISTOR							
7	R67, R98, R99	METAL FILM	1/8W, 1%, 100	RN55C1000F	CRNC	4701-03-1009	3	6-55, 7-49, 8-5	.4
8	R154, R157	METAL FILM	1/8W, 1%, 150	RN55C1500F	CRNC	4701-03-1509	2	7-8, 7-17	.4
9	R217	METAL FILM	1/8W, 1%, 71.5Ω	RN55C71R5F	CRNC	4701-03-7159	1	7-24	.4
10	R60, R67, R130	METAL FILM	1/8W, 1%, 33.2Ω	RN55C33R2F	CRNC	4701-03-3329	4	1-14, 1-19, 5-17	.4
	R132							5-38	
12	R137	METAL FILM	1/8W, 1%, 39.2Ω	RN55C39R2F	CRNC	4701-03-3929	1	1-24	.4
13	R10, R165, R2	METAL FILM	1/8W, 1%, 464Ω	RN55C4640F	CRNC	4701-03-4649	3	1-15, 3-29, 3-42	.4
14	R190, R193	METAL FILM	1/8W, 1%, 511Ω	RN55C5110F	CRNC	4701-03-5119	2	7-23, 7-24	.4
15	R184	METAL FILM	1/8W, 1%, 34.2Ω	RN55C34R2F	CRNC	4701-03-3429	1	7-26	.4
16	R169, R222	METAL FILM	1/8W, 1%, 61.9Ω	RN55C61R9F	CRNC	4701-03-6199	2	2-34, 3-19	.4
17	R48, R49, R50	METAL FILM	1/8W, 1%, 100Ω	RN55C1000F	CRNC	4701-03-1000	14	1-16, 1-19, 2-19	.4
	R55, R56, R58							2-31, 3-16, 3-46	
	R72, R83, R105							4-17, 6-31, 6-33	
	R177, R189, R196							6-35, 6-41, 6-42	
	R199, R220							7-5, 7-10	
18	R119, R122	METAL FILM	1/8W, 1%, 124Ω	RN55B1240F	CRNC	4701-03-1240	2	1-32, 1-18	.4
19	R155, R18	METAL FILM	1/8W, 1%, 150Ω	RN55B1500F	CRNC	4701-03-1500	2	7-16, 7-25	.4
20	R109, R114	METAL FILM	1/8W, 1%, 200Ω	RN55B2000F	CRNC	4701-03-2000	2	2-34, 3-35	.4
21	R52, R133, R147	METAL FILM	1/8W, 1%, 249Ω	RN55B2490F	CRNC	4701-03-2490	3	1-13, 1-35, 2-7	.4
	R153, R168							2-33, 6-10	
22	R53, R57, R120	METAL FILM	1/8W, 1%, 316Ω	RN55D3160F	CRNC	4701-03-3160	3	1-33, 6-34, 6-40	.4
23	R118	METAL FILM	1/8W, 1%, 392Ω	RN55B3920F	CRNC	4701-03-3920	1	1-39	.4
24	R29, R81, R106	METAL FILM	1/8W, 1%, 499Ω	RN55D4990F	CRNC	4701-03-4990	10	2-35, 2-47, 3-6	.4
	R173, R175, R181							3-17, 3-43, 6-16	
	R199, R201, R209							6-22, 5-7, 5-13	
	R212, R225							5-24, 6-1	
25	R110, R113	METAL FILM	1/8W, 1%, 523Ω	RN55D5230F	CRNC	4701-03-5230	2	3-10, 3-31	.4
26	R73, R82	METAL FILM	1/8W, 1%, 576Ω	RN55D5760F	CRNC	4701-03-5760	2	4-1, 4-9	.4
27	R218	METAL FILM	1/8W, 1%, 750Ω	RN55D7500F	CRNC	4701-03-7500	1	6-15	.4
28	R63, R64, R143	METAL FILM	1/8W, 1%, 825Ω	RN55D8250F	CRNC	4701-03-8250	3	1-30, 5-34, 5-41	.4

WAVETEK® PARTS LIST	TITLE	MAIN BOARD	DRAWN BY B. Adkins	NO 185-010 1100-00-0129	REV
	MODEL	185	APPROVAL	SH 2 OF 8	

Form 102

ITEM NO	REF DESIG	DESCRIPTION		MFGR PART NO	MFGR	WAVETEK PART/STOCK NO	QTY	STATION NO	PREP NO
29	R165	METAL FILM	1/8W, 1%, 909Ω	RN55D9090F	CRNC	4701-03-9090	1	2-32	.4
30	R13	METAL FILM	1/8W, 1%, 976Ω	RN55D9760F	CRNC	4701-03-9760	1	7-4	.4
31	R30, R34, R38	METAL FILM	1/8W, 1%, 1.0K	RN55D1001F	CRNC	4701-03-1001	12	1-3, 1-16, 1-29	.4
	R39, R40, R41							1-40, 3-20, 4-5	
	R59, R75, R121							6-8, 6-19, 6-20	
	R125, R140, R142							6-21, 6-22, 7-6	
32	R98	METAL FILM	1/8W, 1%, 1.1K	RN55D1101F	CRNC	4701-03-1101	1	7-50	.4
33	R131, R134	METAL FILM	1/8W, 1%, 1.21K	RN55D1211F	CRNC	4701-03-1211	2	1-11, 1-17	.4
34	R31, R77, R78	METAL FILM	1/8W, 1%, 1.5K	RN55D1501F	CRNC	4701-03-1501	6	2-46, 6-3, 4-5	.4
	R80, R182, R223							5-32, 6-13A, 7-7	
35	R179	METAL FILM	1/8W, 1%, 1.78K	RN55D1781F	CRNC	4701-03-1781	1	2-50	.4
36	R24, R76, R76	METAL FILM	1/8W, 1%, 2.0K	RN55D2001F	CRNC	4701-03-2001	9	1-9, 1-34, 1-41	.4
	R85, R103, R129							1-44, 3-18, 4-6	
	R141, R148, R151							4-8, 4-29, 8-26	
37	R100, R135, R136	METAL FILM	1/8W, 1%, 2.49K	RN55D2491F	CRNC	4701-03-2491	6	1-26, 1-27, 5-18	.4
	R200, R204, R211							5-23, 5-27, 8-18	
38	R51, R188, R5	METAL FILM	1/8W, 1%, 3.01K	RN55D3011F	CRNC	4701-03-3011	4	3-26, 4-45, 7-17	.4
	R27							7-21	
39	R20	METAL FILM	1/8W, 1%, 3.16K	RN55D3161F	CRNC	4701-03-3161	1	3-49	.4
40	R61, R66, R123	METAL FILM	1/8W, 1%, 3.32K	RN55D3321F	CRNC	4701-03-3321	4	1-8, 2-5, 5-36	.4
	R152							5-39	
41	R107	METAL FILM	1/8W, 1%, 4.32K	RN55D4321F	CRNC	4701-03-4321	1	8-28	.4
42	R146	METAL FILM	1/8W, 1%, 4.64K	RN55D4641F	CRNC	4701-03-4641	1	1-36	.4
43	R15, R22, R93	METAL FILM	1/8W, 1%, 4.99K	RN55D4991F	CRNC	4701-03-4991	13	1-10, 1-12, 2-36	.4
	R126, R128, R170							2-43, 4-31, 4-32	
	R178, R183, R191							4-48, 5-5, 5-12	
	R197, R203, R208							5-19, 5-29, 7-16	
	R214							8-10	
44	R207	METAL FILM	1/8W, 1%, 6.19K	RN55D6191F	CRNC	4701-03-6191	1	3-48	.4
45	R180, R4	METAL FILM	1/8W, 1%, 6.98K	RN55D6981F	CRNC	4701-03-6981	2	2-39, 7-12	.4
46	R54, R101, R150	METAL FILM	1/8W, 1%, 7.5K	RN55D7501F	CRNC	4701-03-7501	7	2-1, 2-7, 6-36	.4
	R172, R193, R194							7-45, 7-47, 7-10	
	R6							8-19	
47	R79, R205	METAL FILM	1/8W, 1%, 8.25K	RN55D8251F	CRNC	4701-03-8251	2	4-4, 5-10	.4
48	R69, R70	METAL FILM	1/8W, 1%, 9.53K	RN55D9531F	CRNC	4701-03-9531	2	5-30, 5-31	.4
49	R23, R91, R127	METAL FILM	1/8W, 1%, 10.0K	RN55D1002F	CRNC	4701-03-1002	7	1-5, 3-27, 4-30	.4
	R25, R202, R210							4-36, 5-17, 5-26	
	R12							8-3	

WAVETEK® PARTS LIST	TITLE	MAIN BOARD	DRAWN BY B. Adkins	NO 185-010 1100-00-0129	REV
	MODEL	185	APPROVAL	SH 3 OF 8	

Form 102

ITEM NO	REF DESIG	DESCRIPTION		MFGR PART NO	MFGR	WAVETEK PART/STOCK NO	QTY	STATION NO	PREP NO
50	R62, R65, R86	METAL FILM	1/8W, 1%, 11.0K	RN55D1102F	CRNC	4701-03-1102	5	1-31, 3-39,	.4
	R108, R117							3-45, 4-24,	
51	R11, R17, R124	METAL FILM	1/8W, 1%, 15.0K	RN55D1502F	CRNC	4701-03-1502	10	1-48, 4-23, 4-33	.4
	R143, R186, R187							4-35, 4-46, 4-47	
	R195, R7, R9							7-36, 7-37, 7-38	
	R12								
52	R106, R115	METAL FILM	1/8W, 1%, 19.1K	RN55D1912F	CRNC	4701-03-1912	2	1-36, 3-41	.4
53	R107, R116, R149	METAL FILM	1/8W, 1%, 24.9K	RN55D2492F	CRNC	4701-03-2492	5	1-42, 2-45, 3-24	.4
	R221, R28							3-37, 3-40	
54	R36	METAL FILM	1/8W, 1%, 49.9K	RN55D4992F	CRNC	4701-03-4992	1	1-21	.4
55	R84	METAL FILM	1/8W, 1%, 100K	RN55D1003F	CRNC	4701-03-1003	1	1-45	.4
56	R166, R167	METAL FILM	1/4W, 1%, 124Ω	RC07D1240F	CRNC	4701-13-1240	2	4-24, 4-29	.4
57	R16, R161	METAL FILM	1/2W, 1%, 100Ω	RN65D1000F	CRNC	4701-23-1000	2	8-4 & 8-11	.4
58									
59	R189, R213	CARBON	1/2W, 5%, 3.9Ω	RC20G3R9J	STACK	4700-25-3999	2	5-11, 5-11	.4
60	R159, R162	CARBON	1/2W, 5%, 8.2Ω	RC20GF82J	STACK	4700-25-0829	2	2-45, 2-45	.4
61	R158, R163	CARBON	1/2W, 5%, 100	RC20GF1003	STACK	4700-25-0100	2	2-44, 2-44	.4
62	R16	CARBON	1/2W, 5%, 2.7M	RL20GF275J	STACK	4700-25-2704	1	1-46	.4
63	R14	CARBON	1/2W, 5%, 3.9M	RC20GF395J	STACK	4700-25-3904	1	1-40	.4
64	R97	CARBON	1/2W, 5%, 10M	RC20GF106J	STACK	4700-25-1005	1	6-7	.4
65	R176	CARBON	1W, 5%, 10K	RC32GF103K	STACK	4700-35-1002	1	Bag & I.D.	.4
66									
67	R124	POTENTIOMETER	20Ω	91A820	BRNH	4600-12-2000	1	1-4	
68	R35, R174	POTENTIOMETER	100Ω	91A1	BRNH	4600-12-1010	2	1-44, 7-9	
69	R21, R26	POTENTIOMETER	500Ω	91AR500	BRNH	4600-12-5010	2	3-25, 6-27	
70	R68, R71, R88	POTENTIOMETER	1K	91AR1K	BRNH	4600-12-1020	5-21	6-5, 6-6,	
	R192, R206, R3							7-11, 7-22, 8-27	
71	R33, R35, R92	POTENTIOMETER	100K	91AR100K	BRNH	4600-12-1040	3	3-50, 6-12, 8-6	
72									
73		MATCHED SET							
74	R90	METAL FILM	1/8W, 1%	1K	164-501-89	WVTK	4789-00-0036	1 set	Bag & I.D.	4
75	R94	METAL FILM	1/8W, 1%	10K	164-501-89	WVTK	4789-00-0036	1 set	Bag & I.D.	4
76	R95	METAL FILM	1/8W, 1%	100K	164-501-89	WVTK	4789-00-0036	1 set	Bag & I.D.	4
77	R96	METAL FILM	1/8W, 1%	1M	164-501-89	WVTK	4789-00-0036	1 set	Bag & I.D.	4
78	R215, R216	METAL FILM	1/8W, 1%	10K	142-501-64	WVTK	4789-00-0018	1 set	Bag & I.D.	4
79									
80									
81									

WAVETEK® PARTS LIST	TITLE	MAIN BOARD	DRAWN BY B. Adkins	NO 185-010 1100-00-0129	REV
	MODEL	185	APPROVAL	SH 4 OF 8	

Form 102

ITEM NO	REF DESIG	DESCRIPTION		MFGR PART NO	MFGR	WAVETEK PART/STOCK NO	QTY	STATION NO	PREP NO
82		DIODE							
83	CR6, CR7, CR8	DIODE SILICON		FD7777	FCHLD	4807-02 0777	4	6-27, 8-28, 6-19	4
	CR9							7-20	
84	CR5, CR10, CR11	DIODE SILICON		FD6666	FCHLD	4807-02-6666	25	1-37, 1-38, 2-15	4
	CR12, CR13, CR22							2-16, 2-21, 2-22	
	CR23, CR24, CR25							2-37, 2-38, 2-48	
	CR26, CR27, CR28							3-2, 3-5, 3-28	
	CR29, CR30, CR31							4-12, 4-13, 4-19	
	CR32, CR33, CR34							4-24, 4-25, 4-26	
	CR35, CR36, CR45							4-33, 4-34, 5-42	
	CR1, CR2, CR3							7-32, 7-33, 7-34	
	CR4							7-35	
85	CR37, CR38, CR39	DIODE ZENER		SCE-1	FCHLD	4801-02-0001	6	1-1, 1-2, 5-1	4
	CR40, CR41, CR42							5-2, 5-3, 5-4	
86	CR43	DIODE ZENER		1N4581	FCHLD	4801-01-4581	1	6-1	4
87									
88	CR1-, CR15, CR16	DIODES MATCHED SET		182-500-98	WVTK	4 -00-0010	1 set	Bag & I.D	
	CR17, CR18, CR19								
	CR20, CR21								
89									
90		CAPACITORS							
91	C10, C13, C38	CERAMIC DISC	1000V, .001μF	DD102	CRL		6	3-21, 4-15, 7-5	C4
	C47, C21, C7							4-, 4-27, 6-13	
92	C9, C11, C26	CERAMIC DISC	50V, .01μF	CK103	CRL		33	1-6, 1-7, 1-22	C4
	C27, C37, C40							1-23, 1-28, 1-30	
	C41, C44, C46							1-43, 1-45, 2-2	
	C48, C49, C50							2-18, 2-19, 3-9	
	C52, C53, C54							3-44, 3-44, 4-18	
	C56, C58, C55							4-21, 4-32, 4-42	
	C59, C61, C65							4-44, 4-49, 5-25	
	C68, C72, C77							6-4, 6-7, 6-18	
	C82, C83, C87							6-37, 6-38, 7-43	
	C89, C90, C94							7-46, 8-5, 8-15	
	C2, C3, C6							8-17, 8-21, 8-22	
93	C43, C57, C60	CERAMIC DISC	.1/20V	UK20-104	CRL		7	1-47, 1-48, 2-26	BC
	C66, C69, C74							2-30, 3-8, 7-29	
	C76							8-13	

WAVETEK® PARTS LIST	TITLE	MAIN BOARD	DRAWN BY B. Adkins	NO 185-010 1100-00-0129	REV
	MODEL	185	APPROVAL	SH 5 OF 8	

Form 102

ITEM NO	REF DESIG	DESCRIPTION	MFGR PART NO	MFGR	WAVETEK PART-STOCK NO	QTY	STATION NO	PREP NO
	C28, C39, C62	FRAMIC DISC 1000V, 10%, 5 pf	D0050	CRL				
	C92, C93							
	C26, C35, C73	CERAMIC DISC 1000V, 10%, 10 pf	D0100	CRL				
	C38							
96	C6, C45	CERAMIC DISC 1000V, 10%, 15 pf	D0150	CRL				
97	C25	CERAMIC DISC 1000V, 10%, 22 pf	D0220	CRL				
98	C5, C71, C91	CERAMIC DISC 1000V, 10%, 33 pf	D0330	CRL				
	C1							
99	C24, C23, C30	CERAMIC DISC 1000V, 10%, 47 pf	D0470	CRL				
	C86							
100	C29, C34	CERAMIC DISC 1000V, 10%, 56 pf	D0560	CRL				
101	C31	CERAMIC DISC 1000V, 10%, 68 pf	D0680	CRL				
102	C42, C31, C32	CERAMIC DISC 1000V, 10%, 100 pf	D0101	CRL				
	C75, C93							
103	R	CERAMIC DISC 1000V, 10%, 680 pf	J0681	CRL				
104								
105	C33	SILVER MICA 5%, 47 pf	DM15-470F	SPRC		1	6-48	C4
106	C15	SILVER MICA 1%, 68 pf	DM15-680F	SPRC		1	6-49	C4
107	C16	SILVER MICA 1%, 820 pf	DM15-821F	SPRC		1	6-33	C4
108								
109	C81, C85	ELECTROLYTIC 1000/35V	39010R0035CL4	SPRG		2	Bag & I.D	2 C
110	C29	ELECTROLYTIC 250/15V		SPRG		1	Bag & I.D	BIM
111	C67, C70, C80	ELECTROLYTIC 100/16V	500D107G016DC7	SPRG		3	Bag & I.D.	BIM
	C84, C88							
112	C36	ELECTROLYTIC 200V, 10%, 2uF	2MFW-205K	AM RAD		1	Bag & I.D	2 M
113								
114		VARIABLE 3.5-13pf	75TR1K0-2-3.5/13	STEVNR		1	2-12	
115		VARIABLE 7-35pf	75TR3K0-2-7/35	STEVNR		2	2-47, 6-48	
116								
117		CAPACITOR SET						
	C18	METAL POLYCARBON 1%, 100V, .01uF	130-501-6	WVTK	1309-80-0005	1 set	Bag and T.D.	
	C19	METAL POLYCARBON 1%, 100V, .1uF	130-501-6	WVTK	1309-80-0005			
	C20	METAL POLYCARBON 1%, 200V, .1uF	130-501-6	WVTK	1309-80-0005			
118								
119								
120		TRANSISTORS						
121	Q46	TIP 29 W/Heg Kit	TIP 29	TI	4902-00-0290	1	Bag & I D.	

ITEM NO	REF DESIG	DESCRIPTION	MFGR PART NO	MFGR	WAVETEK PART-STOCK NO	QTY	STATION NO	PREP NO
122	Q53	TIP 30 W/Heg Kit	TIP 30	TI	4902-00-0300	1	Bag & I.D.	
123	Q35, Q36	2N2219	2N2219A	FCHD	4901-01-5040	2	2-13, 2-23	C2
124	Q34, Q37	2N2905	2N2905A	FCHLD	4901-02-2191	2	2-9, 2-27	C2
125	Q5, Q7, Q8	2N3565	2N3565	FCHD	4901-03-5650	3	2-16, 2-21, 6-26	C2
126	Q23	PNP 2N3638	2N3638	FCHD	4901-03-6380	1	6-34	C2
127	Q9, Q10, Q11	2N3640	2N3640	FCHLD	4901-03-6400	3	2-3, 2-18, 6-29	C2
	Q12, Q33						6-30, 6-43	
128	Q22, Q47, Q48	2N3642	2N3642	FCHLD	4901-03-6420	4	5-6, 5-9, 5-22	C2
	Q49						6-34	
129	Q28, Q32, Q40	2N3646	2N3646	FCHLD	4901-03-6460	5	2-7, 2-50, 2-28	C2
	Q44, Q45						4-50, 7-27	
130	Q38, Q39	2N3903	2N3903	FCHLD	4901-03-9030	2	2-41, 2-42	2
131	Q50, Q51, Q52	2N4248	2N4248	FCHLD	4901-04-2480	3	5-14, 5-15, 5-22	C2
132	Q1, Q4, Q16	2N5139	2N5139	MOT	4901-05-1390	13	1-21, 1-27, 1-28	C2
	Q13, Q19, Q20						3-11, 4-2, 4-14	
	Q21, Q24, Q27						4-20, 4-9, 6-23	
	Q29, Q41, Q42						6-32, 7-3, 7-31	
	Q43						7-48	
133	Q6	P FET 2N5462	2N5462	MOT	4901-05-4620	1	6-17	C2
134	Q2	2N5485	2N5485	MOT		1	3-23	C2
135	Q3		TD401	MOT	4901-00-4010	1	3-22	
136								
137								
138	Q15, Q18	TRANSISTOR MATCHED SET	164-501-88	WVTK	4998-00-0005	1 set	Bag & I D.	C2
139	Q25, Q26	TRANSISTOR MATCHED SET	164-501-88	WVTK	4998-00-0005	1 set	Bag & I D	C2
140	Q30, Q31	TRANSISTOR MATCHED SET	164-501-88	WVTK	4998-00-0005	1 set	Bag & I D.	C2
141								
142								
143								
144		INTEGRATED CIRCUIT						
145	IC11, IC12	OP AMP	LA741	SIG	7000-07-4100	2	5-18, 5-28	
146	IC1, IC2, IC5		LM101AH	NAT	7000-03-0100	3	4-38, 4-41, 6-23	
147	IC7		7400	SIG	8000-74-0000	1	3-3, 3-4	
148	IC8		74LS00	TI	8000-74-0010	1	7-41, 7-42	
149	IC9	DUAL 'D' FLIP FLOP	74S174	TI	8000-74-7410	1	7-14, 7-15	
150	IC4	DUAL DIFF AMP	CA3054	RCA	7000-30-5400	1	4-10, 4-11	
151	IC3		CA3096AE	RCA	7000-30-9600	1	7-1, 7-2	
152	IC6		CA3130	RCA	7000-31-3000	1	8-8	

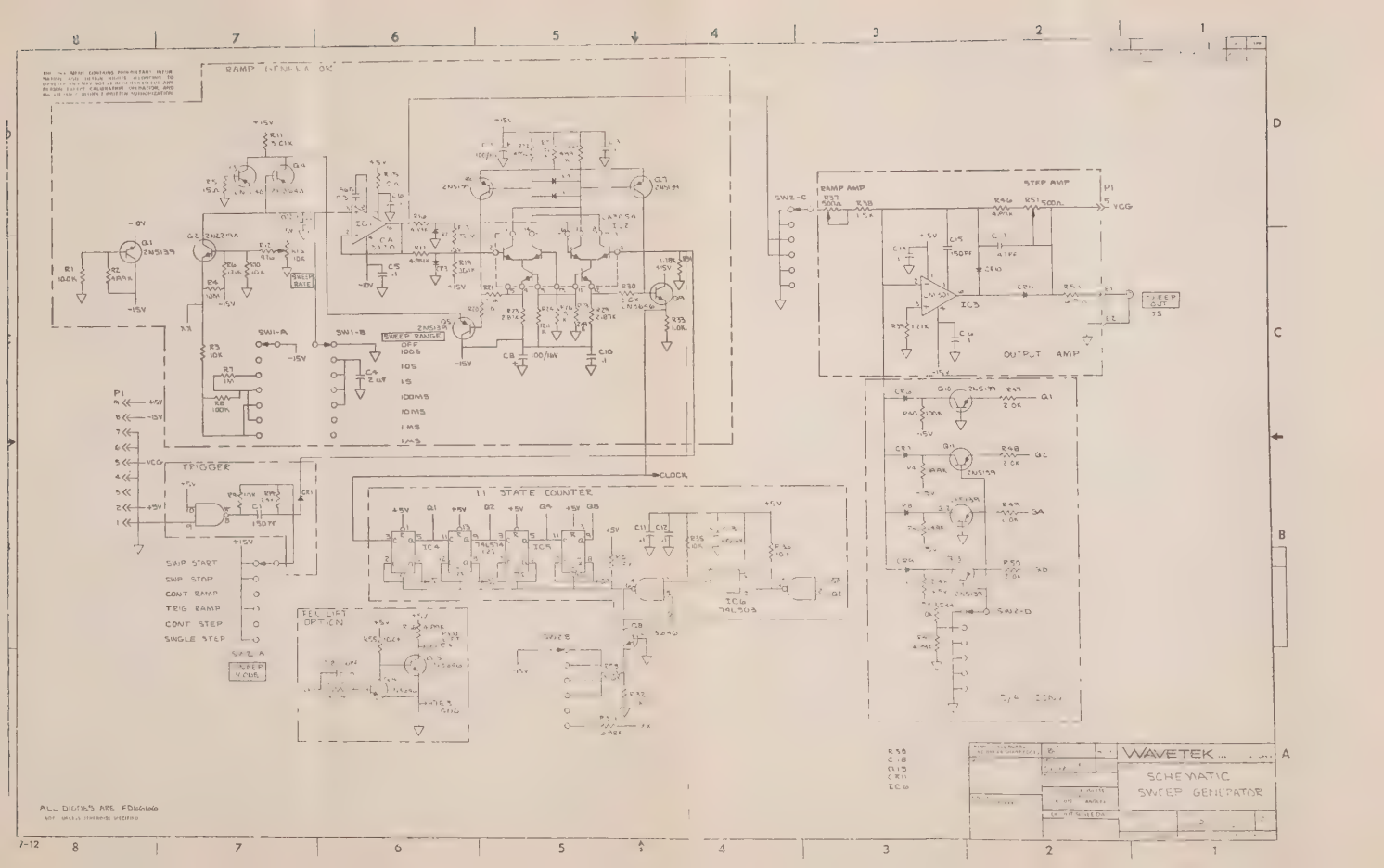
WAVETEK® PARTS LIST — TITLE: MAIN BOARD; MODEL: 185; DRAWN BY: D. Adkins; APPROVAL; NO 185-010; 1100-00-0129; SH 3 OF 8; REV

Form 102

ITEM NO	REF DESIG	DESCRIPTION	MFGR PART NO	MFGR	WAVETEK PART-STOCK NO	QTY	STATION NO	PREP NO
187							4	
188		#4 RADIO FLAT WASHER	3AS620-4					
189							1	
190		CONNECTOR, 9 PIN	09-50-7091	WMEX	2100-02-0051			
191		CONNECTOR PINS (MALE)	08-50-0106	WMEX	2100-05-0075			
192								
193		5V REG W/HTG KIT	780S93		8000-78-0500	1		
194								
195		WIRE						
196		22GA ORANGE			6000-32-2003			
197		22GA YELLOW			6000-32-2004			
198		22GA BROWN			6000-32-2001			
199		22GA VIOLET			6000-32-2007			
200		22GA BLACK			6000-32-2000			
201		22GA BLUE			6000-32-2006			
202		22GA GREEN			6000-32-2005			
203		22GA RED			6000-32-2002			
204		22GA WHITE			6000-32-2009			
205		18GA BLACK			6000-31-8000			
206								
207							4	
208		#2 X 1/4 SCREW P.H.						
209							8	
210		4/40 X 1/2 SCREW P.H.					4	
211		4/40 X 7/8 SCREW P.H.					4	
212		4/40 X 1-1/8 SCREW P.H.					6	
213		4/40 X 5/16 SCREW P.H.					4	
214		NUT #2					18	
215		NUT #4					4	
216		LOCKWASHER #2					20	
217		LOCKWASHER #4						

WAVETEK® PARTS LIST — TITLE: MAT. BOARD; MODEL: 183; DRAWN BY: D. Adkins; APPROVAL; NO 185-010; 1100-00-0129; SH 8 OF 8; REV

Form 102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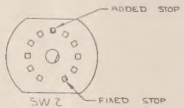
STEP AMP
OUTPUT AMP
SWEEP RANGE
OFF
100S
10S
1S
100MS
10MS
1MS
1MS
TRIGGER
11 STATE COUNTER
SNP START
SNP STOP
CONT RAMP
TRIG RAMP
CONT STEP
SINGLE STEP
SWEEP OUT
75
CLOCK
WAVETEK
SCHEMATIC
SWEEP GENERATOR

SW2

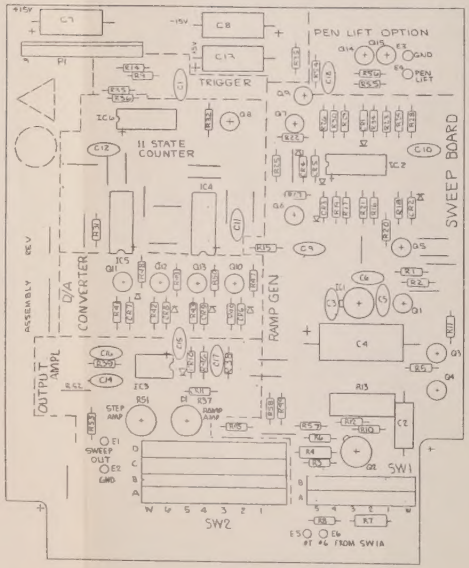
147-400

DETENT SHOWN FROM FRONT VIEW
IN FULL COUNTER CLOCKWISE POSITION



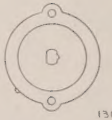
SW 2
134-304-1

11.050 @ 2 X



182-115

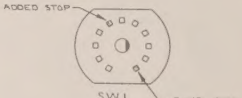
PRICE OUTSIDE BORDER



SW1

130-SW1-2

DETENT SHOWN FROM FRONT VIEW
IN FULL COUNTER CLOCKWISE POSITION



SW1
134-304-2

DRAWN MH	DATE 4/5/79	WAVETEK	
CHECK		TITLE	
AGENCY APPROV		SILKSCREEN ASSEMBLY PRINT (SWEEP PC)	
TOLERANCE			
SCALE 2/1		SERIAL NO. 113	DWG NO. 040-000026 REV A
		2558	SHEET 1 OF 1

ITEM No.	REF DESIG	DESCRIPTION	MFGR PART NO.	MFGR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.
1		SILKSCREEN ASSY PRINT		WVTK	0101-00-0124	1		
2		P. C. BOARD	182-1128	WVTK	1700-00-0124	1		
3		SCHEMATIC	182-212	WVTK	0103-00-0124	1		
4	R13	POT PC MOUNT 10K	A102-314	WVTK		1		
5								
6		JUMPER		WVTK		03		.4
7								
8		RESISTOR						
9	R15	METAL FILM 1/8W, 1%, 10Ω	RN55D10R0F	CRNG	4701-03-1009	1	1-17	.4
10	R5	METAL FILM 1/8W, 1%, 150	RN55D150F	CRNG	4701-03-1509	1	2-44	.4
11	R20	METAL FILM 1/8W, 1%, 100Ω	RN55D1000F	CRNG	4701-03-1000	1	2-32	.4
12	R53	METAL FILM 1/8W, 1%, 619Ω	RN55D6190F	CRNG	4701-03-6190	1	1-44	.4
13	R58	METAL FILM 1/8W, 1%, 3.16K	RN55D3161F	CRNG	4701-03-3161	1	1-48	.4
14	R12	METAL FILM 1/8W, 1%, 976Ω	RN55D9760F	CRNG	4701-03-9760	1	2-47	.4
15	R21, R33	METAL FILM 1/8W, 1%, 1.00K	RN55D1001F	CRNG	4701-03-1001	2	2-1, 2-30	.4
16	R6, R39	METAL FILM 1/8W, 1%, 1.21K	RN55D1211F	CRNG	4701-03-1211	2	1-34, 1-50A	.4
17	R26, R31, R38	METAL FILM 1/8W, 1%, 1.50K	RN55D1501F	CRNG	4701-03-1501	3	1-11, 1-43, 2-11	.4
18	R36	METAL FILM 1/8W, 1%, 1.78K	RN55D1781F	CRNG	4701-03-1781	1	2-15	.4
19	R30, R47, R48 B49, R50	METAL FILM 1/8W, 1%, 2.0K	RN55D2001F	CRNG	4701-03-2001	5	1-18, 1-19, 1-20 1-21, 2-12	.4
20	R25, R28	METAL FILM 1/8W, 1%, 2.49K	RN55D2491F	CRNG	4701-03-2491	2	2-18, 2-19	.4
21	R23, R29	METAL FILM 1/8W, 1%, 2.87K	RN55D2871F	CRNG	4701-03-2871	2	2-13, 2-16	.4
22	R11	METAL FILM 1/8W, 1%, 3.01K	RN55D3011F	CRNG	4701-03-3011	1	2-43	.4
23	R2, R16, F17 R22, R27, R45 R46	METAL FILM 1/8W, 1%, 4.99K	RN55D4991F	CRNG	4701-03-4991	7	1-40, 1-47, 2-10 2-25, 2-29, 2-31 2-37	.4
24	R1, R3, R9 R10, R32, R35 R36, R44	METAL FILM 1/8W, 1%, 10.0K	RN55D1002F	CRNG	4701-03-1002	8	1-2, 1-4, 1-5 1-6, 1-49, 2-36 2-48, 2-50	.4
25	R24	METAL FILM 1/8W, 1%, 12.1K	RN55D1212F	CRNG	4701-03-1212	1	2-17	.4
26	R14, R43	METAL FILM 1/8W, 1%, 12.4K	RN55D1242F	CRNG	4701-03-1242	2	1-1, 1-30	.4
27	R57	METAL FILM 1/8W, 1%, 6.98K	RN55D6981F	CRNG	4701-03-6981	1	1-50	.4
28	R42	METAL FILM 1/8W, 1%, 24.9K	RN55D2492F	CRNG	4701-03-2492	1	1-28	.4
29	R19	METAL FILM 1/8W, 1%, 30.1K	RN55D3012F	CRNG	4701-03-3012	1	2-28	.4
30	R41	METAL FILM 1/8W, 1%, 49.9K	RN55D4992F	CRNG	4701-03-4992	1	1-26	.4
31	R8	METAL FILM 1/8W, 1%, 100K	RN55D1003F	CRNG	4701-03-1003	1	1-32	.4
32	R6	METAL FILM 1/4W, 1%, 1M	RN60D1004F	CRNG	4701-13-1004	1	Bulk	.5
33								

WAVETEK® PARTS LIST — TITLE: SWEEP BOARD — MODEL: 185 — DRAWN BY: B. Adkins — APPROVAL: Frank Fo — NO. 182-012 1100-00-0124 — REV — SH 1 OF 3

Form 102

ITEM NO.	REF DESIG	DESCRIPTION	MFGR PART NO.	MFGR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.
34								
35	R4	CARBON 1/2W, 5%, 10M	RC20GF106J	STACK	4700-25-1005	1	Bulk	.5
36	R37, R51	TRIM POT 500Ω	G91AR-500Ω	HEMN	4400-12-5010	1	Bulk	
37								
38								
39		DIODE						
40	CR1, CR2, CR3 CR4, CR5, CR6 CR7, CR8, CR9 CR10, CR11	DIODE SILICON	FD6686	FCHLD	4807-02-6686	11	1-27, 1-29, 1-31 1-33, 1-39, 1-41 2-14, 2-20, 2-21 2-27, 2-33	.4
41								
42		CAPACITORS						
43	C17	CERAMIC DISC 1000V, 47pf	DD470	CRL		1	1-42	C4
44	C3	CERAMIC DISC 1000V, 56pf	DD560	CRL		1	2-39	C4
45	C1, C15	CERAMIC DISC 1000V, 150pf	DD151	CRL		2	1-3, 1-38	C4
46	C5, C6, C9 C10, C11 C12 C14, C16	CERAMIC DISC 20V, .1μF	UK20-104	CRL		8	1-9, 1-16, 1-35 1-36, 2-24, 2-34 2-38, 2-41	C4
47								
48	C7, C8, C13	ELECTROLYTIC 100/16V	500D107G016DC7	SPRG		3	Bulk	B1
49	C2	MYLAR 200V, .022μF	197P2392	SPRG		1	Bulk	BC4
50	C4	200V, 2.0μF	2MFW-105K	AM RAD		1	Bulk	1.25
51								
52								
53		TRANSISTOR						
54	Q1, Q5, Q6 Q7, Q10, Q11 Q12, Q13	PNP	2N5139	FCHLD	4901-05-1390	6	1-22, 1-23, 1-24 1-25, 2-9, 2-26 2-35, 2-42	C2
55	Q3, Q4	PNP	2N3640	FCHLD	4901-03-6900	2	2-45, 2-46	C2
56	Q2	NPN	2N2219A	FCHLD	4901-02-2191	1	2-40	C2
57	Q8, Q9	NPN	2N3646	FCHLD	4901-03-6460	2	1-10, 2-8	C2
58								
59		INTEGRATED CIRCUIT						
60	IC1	FET OP AMP	CA3130	RCA	7000-31-3000	1	2-40	C4
61	IC2	DUAL DIFF AMP	CA3054	RCA	7000-30-5400	1	2-22, 2-23	
62		OP AMP	LM301A	NAT	7000-30-1041	1	1-37	
63	IC4, IC5	DUAL 'D' FLIP FLOP	74LS74	TI	8000-74-7410	2	1-12, 1-13, 1-14 1-15	

WAVETEK® PARTS LIST — TITLE: SWEEP BOARD — MODEL: 185 — DRAWN BY: B. Adkins — APPROVAL: Frank Fo — NO. 182-012 1100-00-0124 — REV — SH 2 OF 3

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ITEM NO.	REF DESIG	DESCRIPTION	MFGR PART NO.	MFGR	WAVETEK PART/STOCK NO.	QTY	STATION NO.	PREP NO.
64	IC6	QUAD 2 NAND INPUT	74LS03	TI	8000-74-0310	1	1-7, 1-8	
65								
66		AMP PIN	61182-2	AMP	2100-05-0020	2		
67		STANDOFF 5/8"	1531B-5/8-11	USECO	2800-02-0004	4		
68								
69	P1	CONNECTOR 9 PIN	09601091	MOLEX	2100-02-0052	1		
70								
71		SWITCH DETENT	134-304-1	CTS	5104-99-0099	1		
72		SWITCH DETENT	134-304-2	CTS	5104-99-0010	1		
73		SWITCH WAFER	130-SW1-2	CTS		2		
74		SWITCH WAFER	147-400	CTS	5104-02-0015	4		
75								
76		4-40 X 1/2" SCREW P.H.				2		
77		4-40 X 7/8" SCREW P.H.				2		
78		LOCKWASHER 4-40				4		
79								

WAVETEK® PARTS LIST — TITLE: SWEEP BOARD — MODEL: 185 — DRAWN BY: B. Adkins — APPROVAL: Frank Fo — NO. 182-012 1100-00-0124 — REV — SH 3 OF 3

Form 102

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